

A descriptive data structure provides an abstract representation of a rights management data structure such as a secure container. The abstract representation may describe, for example, the layout of the rights management data structure. It can also provide metadata describing or defining other characteristics of rights management data structure use and/or processing. For example, the descriptive data structure can provide integrity constraints that provide a way to state rules about associated information. The abstract representation can be used to create rights management data structures that are interoperable and compatible with one another. This arrangement preserves flexibility and ease of use without compromising security.

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## **TECHNIQUES FOR DEFINING, USING AND MANIPULATING RIGHTS MANAGEMENT DATA STRUCTURES**

### **Field of the Invention**

5           This invention relates to techniques for defining, creating, and manipulating rights management data structures. More specifically, this invention provides systems and processes for defining and/or describing at least some data characteristics within a secure electronic rights management container. The present invention also provides  
10 techniques for providing rights management data structure integrity, flexibility, interoperability, user and system transparency, and compatibility.

### **Background and Summary of the Invention(s)**

          People are increasingly using secure digital containers to safely  
15 and securely store and transport digital content. One secure digital container model is the "DigiBox™" container developed by InterTrust Technologies Corp. of Sunnyvale California. The Ginter et al. patent specification referenced above describes many characteristics of this DigiBox™ container model -- a powerful,  
20 flexible, general construct that enables protected, efficient and interoperable electronic description and regulation of electronic commerce relationships of all kinds, including the secure transport, storage and rights management interface with objects and digital information within such containers.

Briefly, DigiBox containers are tamper-resistant digital containers that can be used to package any kind of digital information such as, for example, text, graphics, executable software, audio and/or video. The rights management environment in which DigiBox™

5 containers are used allows commerce participants to associate rules with the digital information (content). The rights management environment also allows rules (herein including rules and parameter data controls) to be securely associated with other rights management information, such as for example, rules, audit records created during

10 use of the digital information, and administrative information associated with keeping the environment working properly, including ensuring rights and any agreements among parties. The DigiBox™ electronic container can be used to store, transport and provide a rights management interface to digital information, related rules and

15 other rights management information, as well as to other objects and/or data within a distributed, rights management environment. This arrangement can be used to provide an electronically enforced chain of handling and control wherein rights management persists as a container moves from one entity to another. This capability helps

20 support a digital rights management architecture that allows content rightsholders (including any parties who have system authorized interests related to such content, such as content republishers or even governmental authorities) to securely control and manage content, events, transactions, rules and usage consequences, including any

25 required payment and/or usage reporting. This secure control and

management continues persistently, protecting rights as content is delivered to, used by, and passed among creators, distributors, repurposers, consumers, payment disaggregators, and other value chain participants.

- 5           For example, a creator of content can package one or more pieces of digital information with a set of rules in a DigiBox secure container -- such rules may be variably located in one or more containers and/or client control nodes -- and send the container to a distributor. The distributor can add to and/or modify the rules in the
- 10 container within the parameters allowed by the creator. The distributor can then distribute the container by any rule allowed (or not prohibited) means -- for example, by communicating it over an electronic network such as the Internet. A consumer can download the container, and use the content according to the rules within the
- 15 container. The container is opened and the rules enforced on the local computer or other InterTrust-aware appliance by software InterTrust calls an InterTrust Commerce Node. The consumer can forward the container (or a copy of it) to other consumers, who can (if the rules allow) use the content according to the same, differing, or other
- 20 included rules -- which rules apply being determined by user available rights, such as the users specific identification, including any class membership(s) (e.g., an automobile club or employment by a certain university). In accordance with such rules, usage and/or payment information can be collected by the node and sent to one or

more clearinghouses for payment settlement and to convey usage information to those with rights to receive it.

The node and container model described above and in the Ginter et al. patent specification (along with similar other DigiBox/VDE (Virtual Distribution Environment) models) has nearly limitless flexibility. It can be applied to many different contexts and specific implementations. For example, looking at Figures 1A and 1B, a newspaper publisher can distribute a newspaper 102 within a container 100A. A publisher of fashion magazines 106 can distribute the fashion magazines within another container 100C. Similarly, for example, a wholesale banking environment may use yet a further container, an electronic trading system may use a still further container, and so on.

The InterTrust DigiBox container model allows and facilitates these and other different container uses. It facilitates detailed container customization for different uses, classes of use and/or users in order to meet different needs and business models. This customization ability is very important, particularly when used in conjunction with a general purpose, distributed rights management environment such as described in Ginter, et al. Such an environment calls for a practical optimization of customizability, including customizability and transparency for container models. This customization flexibility has a number of advantages, such as allowing optimization (e.g., maximum efficiency, minimum overhead) of the detailed container design for each particular

application or circumstance so as to allow many different container designs for many different purposes (e.g., business models) to exist at the same time and be used by the rights control client (node) on a user electronic appliance such as a computer or entertainment device.

5           While supporting a high degree of flexibility has great advantages, it can produce difficulties for the average user. For example, think of the process of creating a painting. A master painter creates a painting from a blank canvas. Because the canvas was blank at the beginning, the painter was completely unconstrained. The  
10       painting could have been a landscape, a portrait, a seascape, or any other image -- limited only by the painter's imagination. This flexibility allows a master painter to create a masterpiece such as the "Mona Lisa." However, great skill is required to create a pleasing image starting from a blank canvas. As a result, an inexperienced  
15       painter cannot be expected to create a good painting if he or she begins with a blank canvas.

          Consider now an amateur painter just starting out. That person does not have the skill to transform a blank canvas to a pleasing image. Instead of spending years trying to acquire that skill, the  
20       amateur can go out and buy a "paint by numbers" painting kit. Instead of using a blank canvas, the amateur painter begins with a preprinted canvas that defines the image to be painted. By following instructions ("all areas labeled "12" should be painted with dark red," "all areas labeled with "26" should be painted with light blue"), the  
25       amateur can -- with relatively little skill -- paint a picture that is

relatively pleasing to the eye. To do this, the amateur must rigidly adhere to the preprinted instructions on the canvas. Any deviations could cause the final image to come out badly.

Ease of use problems in the computer field can be analogized to the “paint by numbers” situation. If it is important for untrained and/or inexperienced users to use particular software, the system designers can predefine certain constructs and design them into the system. This technique allows inexperienced users to make use of potentially very complicated designs without having to fully understand them – but this normally strictly defines, that is severely limits, the functionality and flexibility available by use of the program. As a result, creative solutions to problems are constrained in order to provide practical value. In addition, even the experienced user can find great advantage in using previously implemented designs. Because a user can program a complex program, for example, does not mean it is appropriate or efficient to create a program for a specific purpose, even if the previously implemented program is not ideal. If the creation of a new program “costs” more to create, that is takes too much time or financial resources, the experienced user will normally use a previously implemented program, if available. Therefore, the greatest total amount of value to be realized, related to customization, is to be able to customize with great ease and efficiency so that the cost of customization will not exceed the benefits.



Uniformity, flexibility, compatibility and interoperability are other considerations that come into play in the computer field, particularly in regards to systems supporting customization. In the painting situation, the human eye can appreciate uniqueness – and the “one of a kind” nature of a masterpiece such as the Mona Lisa is a big part of what makes a painting so valuable. In contrast, it is often desirable to make uniform at least the overall layout and format of things in the computer field. It is much more efficient for a computer to know beforehand how to treat and use objects. If the computer doesn’t know beforehand how to read or handle an input object, for example, then the computer and the object are said to be “incompatible”, i.e., they cannot work together. Computers are said to be “interoperable” if they can work together. Incompatibility and interoperability problems can prevent one computer from talking to another computer, and can prevent you from using computer data created by someone else.

For example, in the non-computer world, a Frenchman who knows only a little English as a second language, might find it far more meaningful and efficient to describe a complex problem in his native tongue, French. But if he is speaking to a second person, an Englishman, and the Englishman does not understand French, the two are not interoperable in French, and the Frenchman must resort to the far less efficient option of speaking in English to the Englishman. Of course, this is far better than if he was trying to speak to a German who understood neither English nor French. Then the two would be

not be “interoperable” in regards to discussing the problem.

Similarly, because rights management containers may potentially be exchanged and used for a large number of different purposes by a large number of different users, groups, and organizations, it is very  
5 important to provide compatibility and interoperability if these different parties, each participating in one or more different rights management models, are to interoperate efficiently. For example, if a rights management container is used to distribute a newsletter and is optimized for this purpose, each reader of the newsletter must have a  
10 computer system or software that “knows” how to read the container and the newsletter it contains. Since commerce, such as distributing newsletters, needs to be as efficient and cost-effective as is feasible, it is important to optimize, that is customize, rights management containers to optimally reflect the requirements of their models and  
15 not to have unnecessary features for each respective application or class of application, since unnecessary features will require unnecessary computing overhead and/or storage space.

Different newsletter publishers may use different container formats customized to their own particular newsletters and/or content  
20 types and/or formats. A newsletter reader interested in many different newsletters may need to be able to read a large number of different formats. It normally will not efficient (or, due to security issues, may not be appropriate) simply to analyze the different containers upon delivery and “try to figure out” or otherwise discern the particular  
25 format in use.

Published standards may help achieve a level of interoperability and standards for given types of applications, but it generally takes a long time for any particular standard to achieve industry-wide acceptance and standards will need to vary widely between categories of applications. Moreover, data structure and other standards are often designed to the lowest common denominator -- that is, they will carry fields and requirements not needed by some, and miss others features optimal in certain cases. There will always be applications that cannot be optimized for efficiency and/or operation if forced to use a specific standard.

Trade-offs between flexibility, ease of use and incompatibility and interoperability can be further complicated when security considerations come into play. To be effective in many electronic commerce applications, electronic container designs should be tamper-resistant and secure. One must assume that any tools widely used to create and/or use containers will fall into the hands of those trying to break or crack open the containers or otherwise use digital information without authorization. Therefore, the container creation and usage tools must themselves be secure in the sense that they must protect certain details about the container design. This additional security requirement can make it even more difficult to make containers easy to use and to provide interoperability.

The above-referenced Ginter et al. patent specification describes, by way of non-exhaustive example, "templates" that can act as a set (or collection of sets) of control instructions and/or data

for object control software. See, for example, the "Object Creation and Initial Control Structures," "Templates and Classes," and "object definition file," "information" method and "content" methods discussions in the Ginter et al. specification. The described templates are, in at least some examples, capable of creating (and/or modifying) objects in a process that interacts with user instructions and provided content to create an object. Ginter et al. discloses that templates may be represented, for example, as text files defining specific structures and/or component assemblies, and that such templates -- with their structures and/or component assemblies -- may serve as object authoring and/or object control applications. Ginter et al. says that templates can help to focus the flexible and configurable capabilities inherent within the context of specific industries and/or businesses and/or applications by providing a framework of operation and/or structure to allow existing industries and/or applications and/or businesses to manipulate familiar concepts related to content types, distribution approaches, pricing mechanisms, user interactions with content and/or related administrative activities, budgets, and the like. This is useful in the pursuit of optimized business models and value chains providing the right balance between efficiency, transparency, productivity, etc.

The present invention extends this technology by providing, among other features, a machine readable descriptive data structure for use in association with a rights management related (or other) data structure such as a secure container. In one example, the machine

readable descriptive data structure may comprise a shorthand abstract representation of the format of the data within a rights management related data structure. This abstract data representation can be used to describe a single rights management data structure, or it may be  
5 generic to a family of data structures all following the format and/or other characteristics the abstract representation defines. The abstract representation may be used to create rights management data structures, allow others (including "other" rights management nodes automatically) to read and understand such data structures, and to  
10 manipulate some or all of the data structures.

The descriptive data structure can be used as a "template" to help create, and describe to other nodes, rights management data structures including being used to help understand and manipulate such rights management data structures.

15 In one particularly advantageous arrangement, the machine readable descriptive data structure may be associated with one or a family of corresponding rights management data structures – and may thus be independent of any specific particular rights management data structure usage. For example, a copy of the descriptive data structure  
20 may be kept with such data structures. Alternatively, some or all of the descriptive data structure may be obtained from somewhere else (e.g., a clearinghouse or repository) and independently delivered on as-needed basis.

In accordance with one example, the machine readable  
25 descriptive data structure provides a description that reflects and/or

defines corresponding structure(s) within the rights management data structure. For example, the descriptive data structure may provide a recursive, hierarchical list that reflects and/or defines a corresponding recursive, hierarchical structure within the rights management data structure. In other examples, the description(s) provided by the descriptive data structure may correspond to complex, multidimensional data structures having 2, 3 or n dimensions. The descriptive data structure may directly and/or indirectly specify where, in an associated rights management data structure, corresponding defined data types may be found. The descriptive data structure may further provide metadata that describes one or more attributes of the corresponding rights management data and/or the processes used to create and/or use it. In one example, the entire descriptive data structure might be viewed as comprising such metadata.

The machine readable descriptive data structure may or may not be, in part or in whole, protected, depending on the particular application. Some machine readable descriptive data structures may be encrypted in whole or in part, while others might be maintained in "clear" form so that they are easily accessible. Some machine readable description data structures, whether encrypted or not, may be in part or wholly protected for integrity using a cryptographic hash algorithm in combination with a secrecy algorithm to form a cryptographic seal, and/or through use of other protection techniques (including hardware, e.g., secure semiconductor and/or hardware

packaging protection means). The machine readable descriptive data structures may themselves be packaged within rights management data structures, and rules (e.g., permissions records) controlling their access and use may be associated with them

5           In accordance with one aspect of how to advantageously use descriptive data structures in accordance with a preferred embodiment of this invention, a machine readable descriptive data structure may be created by a provider to describe the layout of the provider's particular rights management data structure(s) such as secure  
10 containers. These descriptive data structure ("DDS") templates may be used to create containers. A choice among two or more possible DDSs may be based upon one or more classes and/or one or more classes may be based on parameter data. The DDS may be loaded and used as the layout rules for secure containers being created. The  
15 provider can keep the DDS private, or publish it so that other providers may create compatible, interoperable containers based on the same DDS.

          Descriptive data structures can also be used by a container viewer, browser, reader, or any other end user application designed to  
20 work with containers. Truly generic viewers or other applications can be written that can process a container in any format at least in part by making use of descriptive data structures. Thus, a descriptive data structure can be used to at least temporarily convert and/or customize a generic viewer (or other application) into a specialized viewer (or  
25 other application) optimized around one or more classes of

containers. Additionally, specialized readers may be provided to efficiently process descriptive data structures to locate key media elements (e.g., cover page, table of contents, advertiser's index, glossary, articles, unprotected preview, price, and/or rights information regarding viewing, printing, saving electronically, redistributing, related budgets and/or other parameter information, etc.).

Such specialized readers can then seamlessly, transparently, and automatically process to present the user with an easy-to-use interface (for example, an icon display for each of the key media elements) optimized for the specific application, container, and/or user. Different and/or differently presented, such elements may be displayed or otherwise employed based, for example, on the identity of the user and/or user node, including, for example, taking into account one or more class attributes which can influence such automated processing.

Two or more DDSs may be associated with a container and/or container contents, as well as, for example, one or more user and/or node classes. A choice among two or more possible DDSs for a given container and/or class of containers and/or container contents may therefore be based upon one or more classes and/or one or more classes based on parameter data. Overall, this ability to easily characterize, and/or reuse stored, optimized, custom container models and subsequent transparency of translation from such customized containers (e.g., specific DDSs) to general purpose rights



management use is particularly useful. For example, where such customized DDSs can be used as a basis for the creation of customized, optimized display of container content and/or control information to substantially improve the ease of use, efficiency, transparency, and optimization of a distributed, generalized rights management environment. In such an environment, for example, user nodes can interact with different DDSs to automatically adjust to the requirements of the commercial or other rights models associated with such DDSs.

10       Some providers may spend considerable time designing sophisticated container descriptive data structures that describe the layout of their associated containers. With this type of investment in structure and format, the descriptive data structure will often have significant value in their reuse for the same or similar applications.

15       Entities can use descriptive data structures in-house to ensure consistent and highly efficient creation of containers. Third party providers (i.e., a provider other than the one responsible for descriptive data structure creation) can use these descriptive data structures when they wish to create containers compatible with other

20       entities. One example is where the publisher of a widely circulated newspaper develops a descriptive data structure for reading its newspaper. Other, smaller newspapers may want to leverage any viewers or other tools put in place for use with the widely circulated newspaper by adopting the same container format. Descriptive data

25       structures can be copyrighted and/or otherwise protectable by both

law and by the rights management system itself. For example, they may also be protected by their own containers and associated controls to ensure that descriptive data structure creators, and/or distributors and/or other users of such DDSs, receive their fair, rights system managed, return on their descriptive data structure creation and/or use related efforts.

In addition to the foregoing, the following is a list of features and advantages provided in accordance with aspects of this invention:

- 10       • Integrity Constraints: The descriptive data structure allows the provider to protect the integrity of his or her content, by enabling the specification of integrity constraints. Integrity constraints provide a way to state integrity related rules about the content.
- 15       • Application Generation: The descriptive data structure can be used to generate one or more portions of software programs that manipulate rights management structures. For example, a descriptive data structure could serve as 'instructions' that drive an automated packaging application for digital content and/or an automated reader of digital content such as display priorities and organization (e.g.,  
20       order and/or layout).
- 25       • Dynamic user interfaces for creation applications: Applications can read a descriptive data structure to generate an interface optimized for data creation, editing, and/or composition for a specific model, including models

involving, for example, composing complex content from textual, audio, video, and interactive (e.g., querying) elements. The data may take the form of a container, database and/or any other digital information organization as any simple or compound and complex file format. Applications can also read a descriptive data structure to learn how to best display an interface for collection and/or creation of content.

- Dynamic user interfaces for display applications:

Applications can read a descriptive data structure to and generate an interface appropriate for data display. This data may be a container, database or any other compound complex file format. Applications can also read a descriptive data structure to learn how to best display an interface for the presentation of content. Applications can further read a descriptive data structure to learn how to manage display functions related to interacting -- for content creation and/or packaging and/or user display purposes including optimizing any of such interactions -- with other one or more other applications, smart agents, computing environments, identity (including any class identities) of user and/or user nodes, etc. For example, a user interface might be differently optimized for interacting with: a member of the U. S. Air Force versus a faculty member in social sciences at a university; or a member of a Kiwanis

Club versus a member of a Protestant church club, a citizen of the United States versus a citizen of Saudia Arabia, including an appropriate display of expected class membership symbols and related, appropriate organization or suppression of displayed information.

- Ability to automatically identify and locate data fields: Full text search, agents, web spiders, and the like, benefit and are able to interact with information contained within one or more areas of a DDS when areas within a data file are known to contain potentially interesting information and such information is presented in a predefined format.
- Ability to extract needed or desired data without first-hand knowledge of data format: Full text search, agents, web spiders, and the like, benefit and are able to interact with information contained within one or more areas of a DDS when large data files of arbitrary complexity and of unknown origin can be processed without special knowledge.
- Efficient, machine/human readable data abstract: The descriptive data structures can be optimally small, convenient, and cost-effective to process, transmit, and/or store.
- Reusable, salable – independent of actual data: Descriptive data structures may be arbitrarily complex and therefore potentially time consuming to construct and requiring

certain expertise. This gives the descriptive data structure resale value.

- On-the-fly definition and redefinition of content layout:

5 Working with a layout tool allows quick iterations (including editing and modifications) of a design (layout) which can be more convenient and cost-effective than creating such a layout, which also may be quite difficult or beyond the expertise of many users.

10 • Descriptive data structure attributes allow for meta-characteristics not found in actual data: Because the same descriptive data structure is processed by both the creation and post-creation processes, meta-information can be placed into the descriptive data structure that would otherwise be unavailable in the packaged content. One example of this whether display of certain fields is “Required” or “Hidden”.

15 • Enables design automation via descriptive data structure “wizards”: Descriptive data structures themselves enable further automation in the way of “wizards”. There can, for example, be descriptive data structures that help to define other descriptive data structures. Descriptive data structures defining other descriptive data structures might represent the incomplete descriptive data structure for a book or magazine, for example. The “wizard” can comprise a series of dialog boxes displayed to the user to fill in the missing

20

information to make it a completed descriptive data structure.

- 5       • Applications outside of a particular rights management architecture: For example, polymorphous applications may use descriptive data structures to determine certain data visualizations attributes and/or requirements, such as what look and feel should be displayed to the user. For example, if a descriptive data structure contains a word processing document reference, the polymorphous application might  
10       create an interface appropriate for display and editing of a document. If the descriptive data structure contains references to many executable programs, the polymorphous application might ask the user where the files should be saved.
- 15       • Enables umbrella applications to process descriptive data structures and delegate unknown file types and processes: Umbrella (or polymorphous) applications can, for example, act substantially as an operation for a particular data file. This umbrella application may extract and process those  
20       things in the data file that it cares about, while ignoring or delegating (to, for example, user and/or value chain partner (e.g., distributor) to control display of such items) those things it does not understand.

- Runtime interpretation: It is possible to interpret a descriptive data structure at run time, providing materially increased efficiencies and timeliness.
- 5     • Runtime adaptability: Systems can adapt to dynamic data arriving in real time through use of descriptive data structures.
- Automatic conversion capability: Descriptive data structures be used for converting automatically from one format to another.
- 10    • Simplified system design: The use of descriptive data structures may greatly reduce the need for a secondary “wrapper” application programming interface (API) or other arrangement to securely “contain” the container creation process. Such a “wrapper” API to control and otherwise  
15     restrict the container creation process might otherwise be needed to ensure that all created containers are compatible – thereby limiting flexibility and the ability to customize.
- Object oriented template programming environment: The use of display related, interaction related, and rights related  
20     concept objects which may be selected through high-level user interface choices and prioritizations and specification of related parameter data, this enabling very easy creation of certain categories of templates – such as construction and display hint information.

- The use of a template language and interpreter involving supporting programming through use of language elements and interpretation of such language by nodes described in Ginter, et al., where such language includes elements descriptive of display, rights, and program interaction elements, priorities and parameter data.

### **Brief Description of the Drawings**

These and other features and advantages of presently preferred example embodiments in accordance with the invention may be better and more completely understood by referring to the following detailed description along with the drawings, of which:

Figures 1A and 1B show example content containers;

Figures 2A and 2B show example content containers associated with example descriptive data structures;

Figure 3 shows an example descriptive data structures creation and usage process;

Figure 4 shows another example creation and usage process;

Figure 5 shows an example system architecture using descriptive data structures;

Figure 5A shows an example process performed by the Figure 5 system;

Figure 6 shows an hierarchical descriptive data structure organization;



Figure 6A shows an example of how descriptive data structures can be used with atomic transaction data;

Figure 7 shows an example descriptive data structure format;

Figure 8 shows an example descriptive data structure creation  
5 graphical interface;

Figure 9 shows an example process for tracking descriptive data structure rights management related data;

Figure 10A shows an example use of descriptive data structures to provide interoperability between environments; and

10 Figure 10B provides more detail about how the Figure 10A example descriptive data structure may be organized.

### **Detailed Description of Presently Preferred Example**

#### **Embodiments**

Figures 2A and 2B show the example containers 100a, 100c of  
15 Figures 1A, 1B associated with machine readable descriptive data structures 200 and 200'. Referring to Figure 2A, a descriptive data structure 200 is associated with content container 100a. This descriptive data structure 200 may be used to define the content (and certain other characteristics) of container 100a. In the example  
20 shown, descriptive data structure 200 defines a number of sections of newspaper style content 102 such as, for example, the headline (descriptor 202a), the issue date (descriptor 202b), the lead story (descriptor 202c), breaking news (descriptor 202d), image(s)

(descriptor 202e), advertisement (descriptor 202f), and section (descriptor 202g).

The descriptive data structure definitions 202 in this example do not contain or specify the particular contents of corresponding portions of the newspaper 102, but instead define more abstractly, a generic format that a newspaper style publication could use. For example, the Figure 2A example descriptive data structure headline definition 202a does not specify a particular headline (e.g., "Yankees Win the Pennant!"), but instead defines the location (for example, the logical or other offset address) within the container data structure 100a (as well as certain other characteristics) in which such headline information may reside. Because descriptive data structure 200 is generic to a class or family of newspaper style content publications, it can be reused. For example, each daily issue of a newspaper might be created using and/or associated with the same descriptive data structure 200. By abstractly defining the data format and other characteristics of newspaper style content 102, the descriptive data structure 200 allows easy creation, usage and manipulation of newspaper style content 102.

Referring to Figure 2B, a different descriptive data structure 200' may be used to define another class of content publications 106 such as fashion magazines. The descriptive data structure 200' for this content class reflects a different format (and possibly other characteristics) as compared to the descriptive data structure 200 shown in Figure 2A. For example, since fashion magazines typically

do not include headlines or breaking news, the example descriptive data structure 200' may not define such formatting. Instead, descriptive data structure 200' for defining a class of fashion magazine content may define issue date (descriptor 204a), a magazine title (descriptor 204b), the name of a photographer (descriptor 204c) and associated artwork designation (descriptor 204d).

The Figure 2A and 2B examples show descriptive data structures 200, 200' being delivered within content object containers 100a, 100c along with associated content 102, 106. However, other forms of association may be used. For example, descriptive data structure 200 can be independently delivered in its own separate container along with associated rules controlling its access and/or use. Alternatively, descriptive data structures 200 could be stored in a library and delivered on an as needed basis in secure or insecure form depending on particular requirements.

In addition, although Figures 2A and 2B are printed publication content examples, the use of descriptive data structures 200 is not so limited. To the contrary, descriptive data structures 200 can be used to define the format and/or other characteristics associated with a wide variety of different types of digital information including for example:

- images
- sound
- video

- computer programs
- methods
- executables
- interpretables
- 5 • currency objects
- currency containers for currency objects
- rules
- any computer input
- any computer output
- 10 • other descriptive data structures
- any other information.

### **Example Process For Creating and Using Descriptive Data Structures**

Figure 3 shows an example process for creating and using  
15 descriptive data structures 200. In this example, a layout tool 300 is  
used to create descriptive data structure 200. This layout tool 300  
may be, for example, a software-controlled process interacting with a  
human being via a graphical user interface. The resulting descriptive  
data structure 200 (which may be stored on a mass storage device or  
20 other memory) can then be used to facilitate any number of other  
processes to create or interpret stored data. For example, the  
descriptive data structure may be used in a creation process 302. The  
creation process 302 may read the descriptive data structure and, in  
response, create an output file 400 with a predefined format such as,

for example, a container 100 corresponding to a format described by the descriptive data structure 200. A viewing process 304 may use the descriptive data structure 200 to locate important items in the output file 400 for display. A browsing process 306 may use the descriptive data structure 200 to locate items within the stored output file 400 such as, for example, key words or other searchable text. Descriptive data structure 200 may supply integrity constraints or rules that protect the integrity of corresponding content during use of and/or access to the content.

10        Figure 4 shows a more detailed example descriptive data structure creation and usage process. In this example, the layout tool 300 may accept user input 310 provided via a graphical user interface 312. The output of the layout tool 300 may be a descriptive data structure 200 in the form of, for example, a text file. A secure  
15        packaging process 302a may accept container specific data as an input, and it may also accept the descriptive data structure 200 as a read only input. The packager 302a could be based on a graphical user interface and/or it could be automated. The packager 302a packages the container specific data 314 into a secure container 100.  
20        It may also package descriptive data structure 200 into the same container 100 if desired. A viewer 304 may view data 314 with the assistance of the descriptive data structure 200 and in accordance with rules 316 packaged within the container applying to the data 314 and/or the descriptive data structure 200.

### **Example Architecture For Using Descriptive Data Structures**

Figure 5 shows an example secure system architecture suitable for use with descriptive data structure 200. In this example, an electronic appliance 500 of the type described in the above-referenced Ginter et al. patent specification may be provided within a tamper resistant barrier 502. Electronic appliance 500 may include an application program interface (API) 504. One or more applications 506 may communicate with electronic appliance 500 via API 504. In some examples, the application 506 may execute on the secure electronic appliance 500. Each application 506 may include a descriptive data structure interpreter 508. In use, electronic appliance 500 may access secure container 100 and – in accordance with rules 316 – access the descriptive data structure 200 and content 102 it contains and provide it to application 506. The interpreter 508 within application 506 may, in turn, read and use the descriptive data structure 200. In addition, application 506 may be polymorphic in the sense that it can take on personality or behavior as defined at least in part by descriptive data structure 200..

Figure 5A shows an example detailed process performed by the Figure 5 example secure system architecture. In this example, application 506 asks appliance 500 to retrieve the descriptive data structure 200 from container 100 (block 550). Electronic appliance 500 reads the descriptive data structure 200 and, subject to the conditions specified by associated rules 316, provides the descriptive

data structure 200 to the application 506 (block 552). Application 506 then asks its interpreter 508 to interpret the descriptive data structure 200 (block 554). The interpreter 508 tells the application 506 what the descriptive data structure 200 says (block 556). The application 506 extracts or obtains the descriptive data structure information it needs or wants from interpreter 508 (block 558). For example, suppose the application 506 wants to display the "headline" information within newspaper style content shown in Figure 2A. Application 506 may ask interpreter 508 to provide it with information that will help it to locate, read, format and/or display this "headline" information.

As another example, interpreter 508 may provide application 506 with an element identification (e.g., a hexadecimal value or other identifier) that corresponds to the headline information within the newspaper style content (block 558). Application 506 may then ask electronic appliance 500 to provide it with the Headline (or other) content information 102 within container 100 by providing appropriate content information to electronic appliance 500 via API 504 (block 560). For example, application 506 may pass the electronic appliance 500 the element ID that interpreter 508 provided to the application. Even though application 506 may have no direct knowledge of what is inside container 100 (and may only be able to access the container 100 through a secure VDE node provided by appliance 500), interpreter 508 (by looking at descriptive data structure 200) can tell application 506 enough information so that the

application knows how to request the information it wants from the electronic appliance 500.

The electronic appliance may then access information 102 within container 100, and deliver (in accordance with the rules 316 within the container) the requested information to the application 506 (block 562). The application 506 may then use the information electronic appliance 500 provides to it, based at least in part on what interpreter 508 has told it about the content information (block 564). For example, the descriptive data structure 200 may provide characteristics about the way application 506 should handle the information 102. Descriptive data structure 200 can, for example, tell application 506 to always display a certain field (e.g., the author or copyright field) and to never display other information (e.g., information that should be hidden from most users). DDS 200 can also provide complete presentation or "visualization" information so that an information provider can, for example, control the look and feel of the information when it is displayed or otherwise rendered. Descriptive data structure 200 may provide encodings of other characteristics in the form of metadata that can also be used by application 506 during a process of creating, using or manipulating container 100. The DDS 200 can be used to generate a software program to manipulate rights management structures. For example, a DDS 200 could serve as the 'instructions' that drive an automated packaging application for digital content or an automated reader of digital content.



### **Example Description(s) Provided by Descriptive Data Structure**

Figure 6 shows one example of how a descriptive data structure 200 may describe and define an arbitrarily complex, information structure such as, for example, an hierarchical container 100. In this particular example, container 100 includes properties 600(1), 600(2). Property 600(1) may include n attributes 602(1), 602(2) ... 602(n). Property 600(2) may include any number of attributes 604(1), 604(2), and it may also include an additional property 606. Property 606 may, in turn, include its own attributes 608(1), 608(2) ... . Associated descriptive data structure 200 may be organized as a tree structure list 250 providing a recursive structure to reflect the recursive structure of the contents of container 100. For example, list 250 may include "branches" in the form of "property" descriptors 252(1), 252(2) corresponding to properties 600(1), 600(2). Each property descriptor 252 may, in turn, include a list 254 of attributes and may include additional property descriptors 256 in the same recursive, hierarchical arrangement as is reflective of the example content container structure. DDS 200 may be used to describe arbitrarily complex, hierarchical or non-hierarchical data structures of any dimension (1 to n).

Figure 6A shows that descriptive data structure 200 can be used in conjunction with any kind of information such as, for example, events or methods defining an "atomic transaction" such as a real estate transaction. In this Figure 6A example, a container 100

includes one or more descriptive data structures 200 and associated control set(s) 316 relating to a sequence of “events” 700 that define a real estate transaction. The DDS 200 may, for example, include a number of different entries 200A-200N pertaining to each different  
5 “event” within the transaction (e.g., “offer”, “acceptance”, “purchase/sales”, “inspection”, “mortgage”, etc.). These entries 200A-N may, for example, define where in container 100 the event can be found. The entries 200A-200N may also include metadata that provides additional characteristics corresponding to the event (for  
10 example, how certain information related to the event should be displayed).

### **Example Descriptive Data Structure Formatting**

Figure 7 shows an example of how descriptive data structure 200 may be formatted. As mentioned above, descriptive data  
15 structure 200 may comprise a list such as a linked list. Each list entry 260(1), 260(2), ... may include a number of data fields including, for example:

- an object name field 262,
- one or more metadata fields 264 (which may be part of  
20 and/or referenced by the descriptive data structure); and
- location information 266 (which may be used to help identify the corresponding information within the container data structure 100).

The object name field 262 may include a constant that may corresponds to or describes a type of information. For example, object name field 262 may act as a “handle” to the content or data; it may be an indirect reference to the content or data; and/or it may be used to look up the content or data. The following are examples of object names:

General Purpose Object Names

	NUMBER
	STRING
10	DATE
	TITLE
	DESCRIPTION
	AUTHOR
	PROVIDER
15	MIME_TYPE
	VERSION
	URL
	EMAIL
	NEWGROUP
20	FILE_NAME
	KEYWORDS
	CREATION_DATE
	MODIFICATION_DATE
	LAST_ACCESS_DATE

	NATIVE_PLATFORM
	SIZE
	CONTENT
	PREVIEW
5	THUMBNAIL
	TEXT
	ARTWORK
	ILLUSTRATION
	UNKNOWN
10	TEMPLATE
	BILLING_NAME
	CONTAINER
	Book-style Object Names
	DEADLINE_DATE
15	TITLE_PAGE
	PROLOGUE
	INTRODUCTION
	ABSTRACT
	TABLE_OF_CONTENTS
20	CHAPTER
	CHAPTER_NUMBER
	INDEX
	Electronic Mail-style Object Names
	FROM

TO  
CC  
SUBJECT  
MESSAGE\_BODY  
5 ENCLOSURE

Newspaper-style Object Names

ISSUE\_DATE  
ARTICLE  
COLUMN  
10 COVER\_STORY  
LEAD\_STORY  
BREAKING\_NEWS  
ADVERTISEMENT  
SECTION  
15 EDITORIAL

The DDS 200 may include or reference any type of data or metadata. In one example, the DDS 200 uses the object name field 262 to point to or refer to metadata. This metadata can define certain characteristics associated with the object name. For example, such  
20 metadata may impose integrity or other constraints during the creation and/or usage process (e.g., “when you create an object, you must provide this information”, or “when you display the object, you must display this information”). The metadata 264 may also further describe or otherwise qualify the associated object name.

In one preferred example, the DDS 200 uses object name 262 to refer to metadata stored elsewhere – such as in a container 100. This referencing technique provides several advantages. For example, one situation where it may be useful to store the metadata in a secure container 100 separately from DDS 200 is in situations where it is desirable to make the DDS readily accessible to an outside application but to protect the associated metadata. For example, consider the case of handling web spider queries. A web spider may query the DDS 200 for a particular object name 262. If the object name is found, then the web spider may request the corresponding metadata. The web spider may have ready access to the metadata, but may only be able to access the associated metadata from the container 100 under appropriate conditions as controlled by a corresponding secure electronic appliance 500 based on associated rules 316. As another example, storing metadata separately from the DDS 200 may allow the same DDS to be used with different metadata in different contexts. Suppose for example that a DDS 200 contains an Object Name, for example KEYWORDS. When DDS 200 is associated with container 100A, then the DDS Object Name KEYWORDS refers to container 100A's KEYWORDS metadata. Conversely, if later this same DDS 200 is associated (e.g., packaged with) a different container 100C, then the DDS Object Name KEYWORDS refers to container 100B's KEYWORDS data.

Although it is preferred to use object name 262 to refer to metadata stored elsewhere, there may be other instances where there

is a need or desire to explicitly include metadata within the DDS 200. For purposes of illustration, Figure 7 shows an example DDS 200 that includes metadata field 264 and also refers to metadata within a container 100 using the object name 262. Either or both techniques  
5 may be used.

The DDS 200 thus allows value chain participants to protect the integrity of content, by enabling the specification of integrity constraints. DDS 200 integrity constraints provide a way to state rules about the content. For example, DDS 200 can specify that an article  
10 of a newspaper cannot be viewed without its headline being viewed. The corresponding integrity constraint can indicate the rule 'if there is an article, there must also be a headline'. Another example is a photograph that is part of a magazine and the credit that goes with it. The integrity constraint rule provided by DDS 200 might be 'do not  
15 present this photograph without its associated credit'.

DDS integrity constraints give value chain participants a tool for protecting the use of the DDS 200, ensuring that content represented by a particular DDS contains all the essential components--that it is representative of the DDS. This gives providers  
20 a way to set up conventions and enforce standards of use. There are many possible integrity constraints. The following are a few examples:

- Required: a is required as part of the content
- Optional : a is an optional component of the content

- Required relationship: if a is present, then b must be present, or if a is present b, c and d must be present. Conversely, if b is not present, then a is not allowed to be present. Relationships in this category are 1:m where  $m > 0$ .
- 5 • Optional relationship: If a is present b may or may not be present. If b is present, then a is guaranteed to be present. Relationships in this category are 1:n, where  $n \geq 0$ .
- Repetition: a must occur n times where  $n > 1$ . This could be specified with ranges of values, etc.
- 10 • Other rules and/or requirements.

Metadata 264

### **Example Graphical Interface For Creating Descriptive Data Structures**

Figure 8 shows an example descriptive data structure creation graphical user interface 312. In this example, the graphical user interface 312 may prompt the user for the object name. In addition, the graphical user interface 312 may provide options for specifying the associated metadata 264. The options shown in Figure 8 may, for example, include:)

- 20 • “construction type” metadata (upon object construction, the information is required; upon object construction, the object creation tool is to always or never prompt for the information);



- display metadata (e.g., always display the associated information (e.g., for copyright notices, author names and the like) or always or never make the information visible; and/or
- 5 • layout “hints” and field definitions (e.g., text, text block, integer, file, image or other data type).

The above metadata descriptions are non-limiting examples. Other metadata characteristics and attributes may be used.

#### **Example Process Using Descriptive Data Structures**

10 Figure 9 shows one example arrangement for using the infrastructure described in co-pending related U.S. patent application serial no. 08/699,712 (referenced above) for descriptive data structures 200. The arrangement shown in Figure 9 may be useful in a number of different contexts. For example, a provider 600 of  
15 descriptive data structures 200 may want to know which descriptive data structures 200 are the best liked by his customers so he or she can improve the quality of his products. Or, a provider 600 may charge customers for using descriptive data structures 200 on a per use or other basis. In still another example, some descriptive data  
20 structures 200 or classes of DDS 200 may be restricted to use only by authorized users or classes of authorized users.

Figure 9 shows a DDS provider 600 who delivers a DDS 200 and an associated control set 316 to a value chain participant 602.

Controls 316 may provide rules and associated consequences for controlling or otherwise affecting the use or other aspects of what value chain participant 602 can do with DDS 200. The controls 316 and DDS 200 may be packaged within a container 100. Value chain  
5 participant 602 may get the container 100 containing DDS 200 directly from DDS provider 600; alternatively, the provider can provide it a rights and permissions clearinghouse 604 and participant 602 and get it from the clearinghouse (or elsewhere) (see container 100B).

10 Value chain participant 602 can use DDS 200 to author content 102. Participant 602 can package content 102 with associated controls 316A in a container 100A. Participant 600 may, if he desires, include DDS 200 and associated controls 316a, 316b with content 102 in the same container – or depend on the provider 600  
15 and/or rights and permissions clearinghouse 604 to independently deliver the DDS and its controls to end users 606 in another container 100c for example.

End users 606(1), ..., 606(n) use DDS 200 (in accordance with controls 316) in conjunction with content 102 (for example, to read,  
20 browse or otherwise access the container content). Controls 316, 316A may require user appliances to provide usage data 610 to a usage clearinghouse 612. The usage clearinghouse 612 can provide usage data 610A related to access and/or usage of DDS 200 to DDS provider 600, and may independently provide usage data 610B related  
25 to access and/or usage of content 102 to value chain participant 602.

**Descriptive Data Structures Can Be Used to Achieve  
A Degree of Interoperability Between Rights  
Management Environments**

Descriptive data structures 200 provided in accordance with the  
5 present invention can provide a degree of interoperability between  
source and target rights management environments, and/or to provide  
a bridge to achieve at least some degree of interoperability between  
a rights management environment and the outside world.

Different rights management environments may have  
10 substantially incompatible mechanisms for defining rights pertaining  
to an object. Descriptive data structures 200 can provide at least a  
partial bridge to achieve a degree of compatibility and  
interoperability. For example, a provider that defines an object within  
a source rights management environment may create a descriptive  
15 data structure for use by processes within one or more target rights  
management environments. For example, an object creator or other  
provider can specify, within a descriptive data structure 200, certain  
rules, integrity constraints and/or other characteristics that can or  
should be applied to the object after it has been imported into a target  
20 rights management environment. The target rights management  
environment can choose to selectively enforce such rules, constraints  
and/or other characteristics depending on the degree to which it can  
trust the source environment. For example, objects imported from an  
EDI system employing X.12 security may be more trustworthy than  
25 objects presented from environments with lesser (or no) security.

In another example, a provider that creates an object outside of any rights management environment can create a descriptive data structure 200 for use if and when the object is imported into one or more rights management environments. The target rights management environment(s) can use such descriptive data structure(s) to help efficiently understand and handle the object. Further, a descriptive data structure created within a rights management environment can be exported to one or more applications outside of the rights management environment and used to assist the application(s) in interpreting exported content or other information.

Figure 10A shows an example of how descriptive data structures 200 may be used to provide interoperability. In the Figure 10A example, a DDS creation tool 800 creates a DDS 200 that includes one or more target data blocks 801. In one example, the DDS creation tool 800 may be based on, and/or incorporate some or all of the capabilities of layout tool 300 and provide interoperability capabilities in addition to features associated with layout tool 300. In another example, DDS creation tool 800 may not incorporate any of the capabilities of layout tool 300, and may create DDS 200 solely for interoperability purposes. DDS creation tool 800 may, for example, be an application program with a graphical user interface, a background process that only displays a user interface when being configured by a user, a portion of an operating system, a portion of a computer's firmware, a server process that may act independently or as part or all of a "gateway" between one system and another (e.g., a

public network and a private network, two or more private networks, a local area network and a wide area network, etc.), or any other desirable implementation or integration.

5 Target data block 801 may provide information used to provide interoperability with a particular target environment 850. A single DDS 200 can, in one example, provide interoperability with N different target environments 850 by including N target data blocks 801(1), ...801(N) each corresponding to a different target environment 850(1), ... 850(N).

10 In this example, each target data block 801 includes rule (control) information. Different target data blocks 801 can provide different rule information for different target environments 850. The rule information may, for example, relate to operations (events) and/or consequences of application program functions 856 within the associated target environment 850 such as specifying:

- permitted and/or required operations;
  - nature and/or extent of operations permitted and/or required operations; and/or
  - consequences of performing permitted and/or required operations.
- 20

The target data block 801 may also include additional information if desired that gives directions to a DDS parser 852 and/or a translator 854 within a corresponding target environment 850.

Figure 10B shows one detailed example of how target information may be organized within DDS 200. In this example, DDS creation tool 800 creates a DDS header 805 that references one or more target record headers 807. DDS header 805 may, for example, include a "number of targets" field 809 indicating the number of target data blocks 801 within the DDS 200, a "offset to first target data portion" field 811 that provides the location of the first target data block 801(1) within the DDS 200, a source message field 812A that identifies the source environment, and an optional creator seal 812B that may be used to verify the integrity and authenticity of the DDS 200. Source message field 812A (which can be optional) may include a source ID that may be used to help verify the source environment of DDS 200, and an optional source seal (that may or may not be present in the source message). Each target data block 801 within DDS 200 may begin with a target record header 807 including a "target ID" field 813, a "length" field 815, a "offset to next target data portion" field 817, an optional creator seal 819, and an optional source message 821. The "target ID" field 813 may specify a unique identification number or value corresponding to the associated target data block 801 and/or identifying the intended target environment(s), the "length" field 815 may specify the length of the target data block 801, and the "offset" field 817 may specify the location (relative or absolute) of the next target data

block 801 within the DDS 200 (and may take on a null value for the last target data block).

5       The optional creator seals 812B, 819 (and source seals) may be cryptographic seals that help to ensure that the DDS 200 and target records 801, respectively, have not be altered since they were created, and also the identity of the DDS 200's creator and/or source. The optional source messages 812C and 821 may be information that helps to ensure that a target environment knows which source environment created DDS  
10       200.

Referring again to Figure 10A, DDS creation tool 800 may, upon creating the DDS 200, cryptographically seal it and each target data block 801 for integrity using appropriate cryptographic processes, for example by first running a cryptographic hash function  
15       (e.g., SHA, MD5, etc.) on the data and then encrypting the resulting hash value using a private key of the DDS creator associated with an asymmetric cryptosystem (e.g., RSA, El Gamal, etc.). If sealing is used, the DDS creator preferably should ensure that the public key associated with the encrypting private key is certified (e.g., encrypted  
20       with a private key of a certifying authority) and available for use by target environments to validate the seal (e.g., by including a certificate in DDS 200, publishing the certificate on a public network, etc.)

      If source messages 812C, 821 are used, they should preferably  
25       represent information provided by the source environment that may

help a target environment identify the source environment, and further may also help to ensure that the DDS 200 was actually created by the source environment (and therefore may, for example, be trusted to the extent that the source environment is trusted). For example, a source environment may have a protected processing environment (PPE) of the form described in the above referenced Ginter, et al. patent application. Certain of such PPEs may have cryptographic keys (e.g., a private key of a public key/private key pair) available that may be used to encrypt a cryptographic hash taken of the DDS header 805 or target block header 807, as appropriate. In such an example, a target environment would need to acquire a corresponding cryptographic key (e.g., a public key of a public key/private key pair) using trusted techniques (e.g., delivery in a certificate signed by a trusted certifying authority) in order to evaluate such a source message. In another example, DDS creation tool 800 may have been equipped with cryptographic keys when it was manufactured, and may use these cryptographic keys instead of keys from a PPE, although generally this technique would be more susceptible to tampering by an experienced computer hacker and might therefore be somewhat less trusted by target environments.

In addition, or alternatively (for example, if cryptographic techniques are not appropriate or desired), the source message may contain a unique identifier that corresponds to the source environment.



The DDS creation tool 800 (see Figure 10A) may then package the resulting DDS 200 into a secure container 100 along with an associated object 830. In another example, DDS creation tool 800 may embed DDS 200 within, or otherwise associate the DDS with, an object 830' that provides a method for releasing the DDS to the target environment parser 852. The DDS 200 and its associated object 830 may then be delivered to one or more target environments 850 for processing.

Target environment parser 852 (and/or translator 854) may, for example, be part of an application program, part of an operating system, or part of a utility program used by, or in conjunction with, an application program and/or an operating system. The target environment parser 852 receives the DDS 200 and parses it to locate the target data block 801(k) corresponding to the target environment 850 (k). Parser 852 may then determine, from the corresponding target data block 801, the rules the target data block contains. Parser 852 preferably understands enough about the structure of DDS 200 to find (e.g., using the header information shown in Figure 10B) the appropriate target data block 801 corresponding to it, and also to understand the rules within the target data block. The target environment parser 852 doesn't need to understand any additional rules 316 that may be packaged within container 100 or otherwise delivered with object 830, but it may use any such additional rules if desired (e.g., when it finds no target data block 801 within DDS 200 for the particular target environment 850 (for example, if it is capable

of understanding some other target data block 801 whose rules are based on a published specification and/or standard)).

The target environment parser 852 may obtain applicable target rules from target data block 801 and provide these rules to application  
5 program functions 856. Application program functions 856 may define any operation pertaining to object 830 such as for example:

- cut
- copy
- print
- 10 • paste
- save
- change
- delete
- any other operation.

15 The target rules provided by parser 852 may be used, for example, to permit, require and/or prevent certain operations; to define the extent to which certain operations can be performed (e.g., limit number of copies, define extent of cut, the rules that should be applied to cut information in subsequent use, etc.); and/or to define  
20 the consequences of performing a particular operation (e.g., charge the user for printing or otherwise using and/or accessing all or part of object 830, maintain records of the time and/or number of such operations performed, etc.).

Parser 852 may also, or alternatively, provide some or all of the  
25 rules it obtains from target data block 801 to other arrangements for

applying the rules such as, for example, the “other rights management functions” block 858. Block 858 may provide any kind of rights management functions. Translator 854 may be used if needed to allow the application program functions 856 and/or the “other rights management” block 858 to understand the rules. As one example, translator 854 may be used to further elaborate, parameterize and/or secure the rule information obtained from target data block 801 so they are more or fully compatible with the “other rights management functions” block 858.

10           A useful data structure definitional method and arrangement has been described in connection with its most practical and presently preferred example embodiments. The present invention is not to be limited to those embodiments, but on the contrary, is intended to encompass variations and equivalents as defined within the spirit and  
15   scope of the claims.

**We Claim:**

1. A data processing method comprising:  
creating a machine readable, abstract descriptive data structure;  
and  
5 using the representation to interoperate with at least one rights  
management data structure.
2. A method as in claim 1 wherein the using step includes the  
step of formatting at least one part of at least one rights management  
data structure at least in part in accordance with the descriptive data  
10 structure.
3. A method as in claim 1 wherein the using step includes the  
step of formatting display of at least one part of at least one rights  
management data structure at least in part in accordance with the  
descriptive data structure.
- 15 4. A method as in claim 1 wherein the using step includes the  
step of formatting reading of at least one part of at least one rights  
management data structure at least in part in accordance with the  
descriptive data structure.
- 20 5. A method as in claim 1 wherein the using step includes the  
step of displaying at least a part of at least one rights management  
data structure based at least in part on the descriptive data structure.
6. A method as in claim 1 wherein the creating step includes  
the step of providing metadata within the descriptive data structure,

and the displaying step comprises displaying at least some information from the rights management data structure at least in part in accordance with the metadata.

7. A method as in claim 1 wherein the using step includes the  
5 step of dynamically generating a user interface based at least in part on the descriptive data structure.

8. A method as in claim 1 wherein the using step includes the step of automatically identifying and/or locating at least one data field at least in part based on the descriptive data structure.

10 9. A method as in claim 1 wherein the using step includes the step of automatically extracting data within the rights management data structure based at least in part on the descriptive data structure.

10. A method as in claim 1 wherein the creating step comprises creating a descriptive data structure that is independent of  
15 any particular rights management data structure but abstractly describes a class of rights management data structures.

11. A method as in claim 1 wherein the creating step includes the step of creating metadata for defining at least one characteristic of the using step.

20 12. A method as in claim 1 wherein the creating step includes the step of creating the abstract representation at least in part by using a wizard, the operation of the wizard being defined at least in part by a further descriptive data structure.

13. A method as in claim 1 wherein the using step includes the step of altering the behavior of a polymorphous process at least in part based on the descriptive data structure.

14. A method as in claim 1 wherein the using step includes the  
5 step of interpreting at least part of the descriptive data structure at run time.

15. A method as in claim 1 wherein the using step includes the step of dynamically adapting at least part of data processing of the rights management data structure at run time.

10 16. A method as in claim 1 wherein the using step includes using at least part of the descriptive data structure as instructions for driving and automated digital content handler.

17. A method as in claim 1 wherein the creating step includes the step of creating at least one integrity constraint, and the using step  
15 includes the step of enforcing the integrity constraint.

18. In a rights management data processing architecture of the type including a secure electronic appliance that interacts with an application through an interface, a method of interoperating with secure electronic containers comprising the following steps:

20 (a) delivering an abstract data structure representation to the application;

(b) generating container access requests with the application based at least in part on the abstract data structure representation; and

(c) accessing the container with the secure electronic appliance at least in part based on the container access requests the container generates.

19. A method as in claim 18 further including the steps of:

5 (d) providing, with the secure electronic appliance, information from the container to the application; and

(e) processing the provided information at least in part in accordance with the abstract data structure representation.

20. A method as in claim 19 wherein the processing step (e)  
10 includes the step of processing the provided information in accordance with metadata provided within the abstract data structure representation.

21. A method of creating and using a secure container comprising:

15 (a) defining a descriptive data structure that generically defines a class of interoperable, compatible container structures;

(b) using the descriptive data structure to create at least one secure container;

(c) distributing the descriptive data structure to plural  
20 electronic appliances; and

(d) interoperating with the secure container at said plural electronic appliances by at least in part using the descriptive data structure to locate and/or specify information within the secure container.

22. A method as in claim 21 wherein the descriptive data structure corresponds to an atomic transaction, and the method further includes the step of performing the atomic transaction at least one of said plural electronic appliances at least in part in accordance with the  
5 descriptive data structure.

23. A method as in claim 21 further including the step of independently using and/or providing controls relating to the descriptive data structure.

24. A method as in claim 21 further including the step of  
10 defining at least one class of descriptive data structure based on at least one parameter.

25. A descriptive data structure comprising:  
first data that at least in part establishes an association between the descriptive data structure with at least one rights management data  
15 structure;

second data that locates at least some information within the associated rights management data structure; and

metadata that at least in part describes at least one characteristic of use and/or access of the rights management data structure.

20 26. A descriptive data structure as in claim 25 wherein the metadata includes at least one integrity constraint.

27. A method of achieving a degree of compatibility with at least one secure environment comprising:

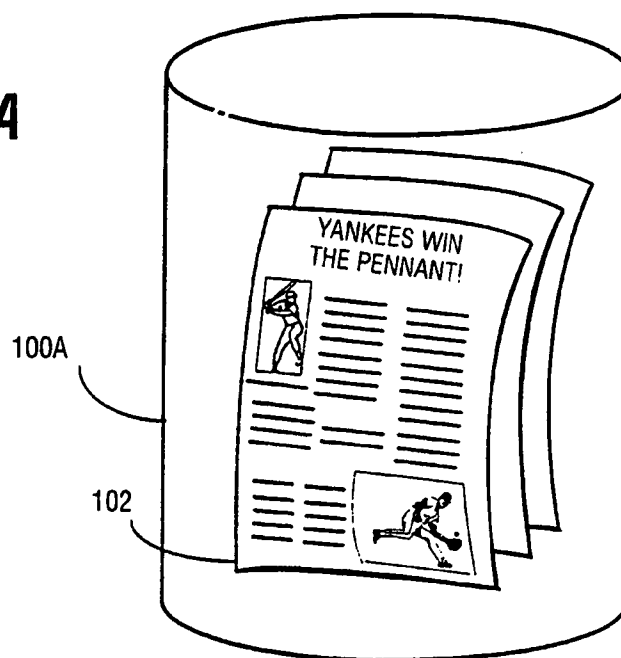


- (a) creating a descriptive data structure;
- (b) associating the descriptive data structure with at least one object; and
- (c) presenting the object and associated descriptive data structure to the secure environment; and
- (d) interoperating with the presented object at least in part based on the descriptive data structure.

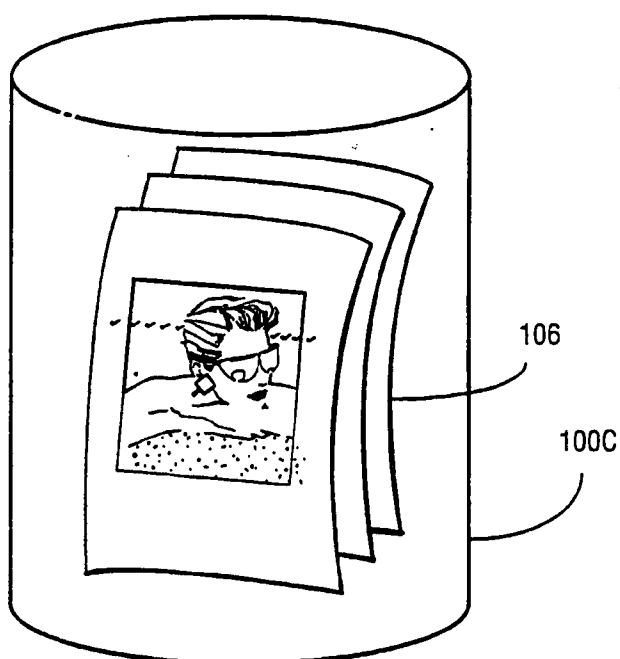
28. A method as in claim 27 wherein step (d) includes the step of selectively interoperating with the presented object based on the degree to which the secure environment can trust the source of the object and/or the descriptive data structure.

1/14

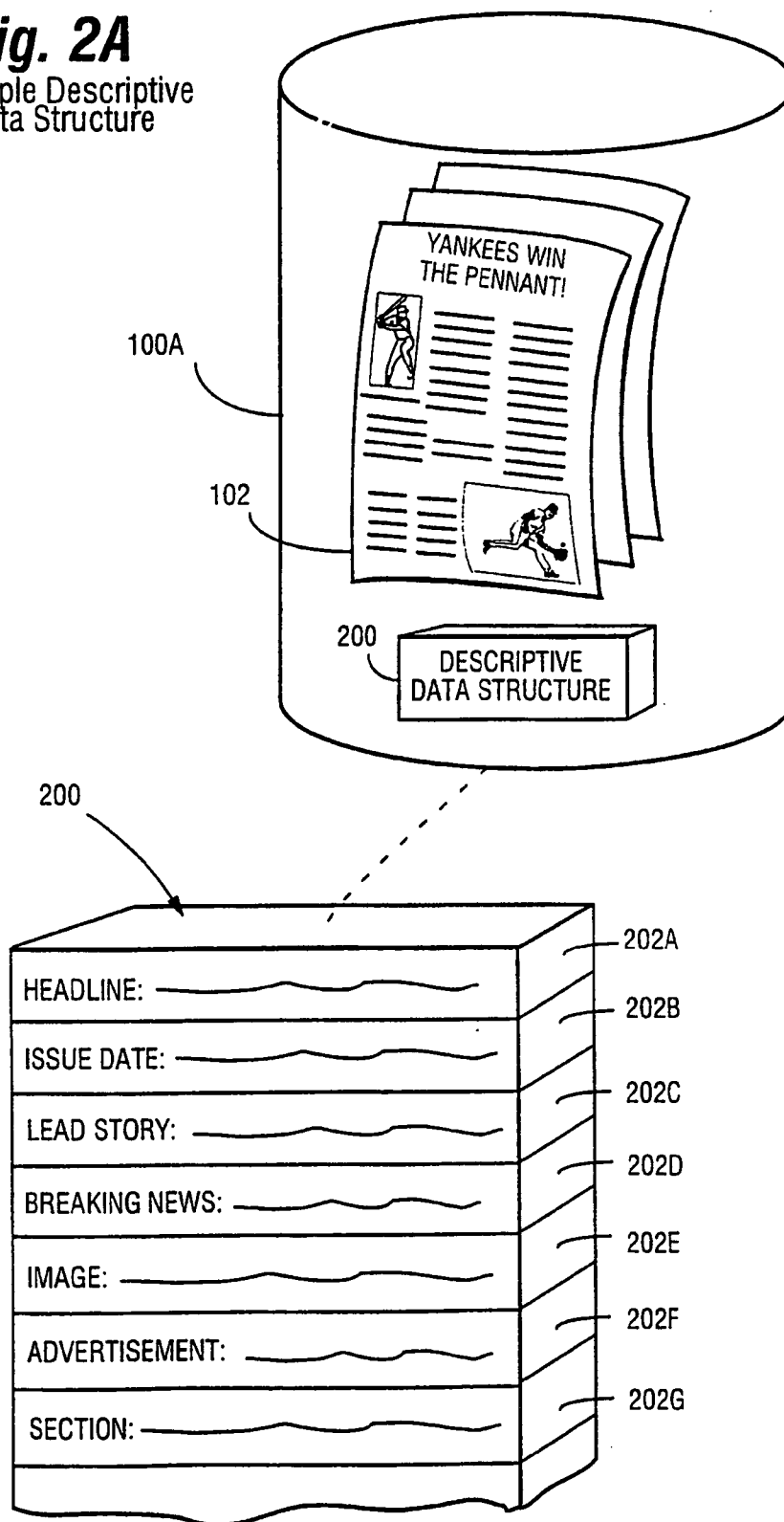
**Fig. 1A**



**Fig. 1B**

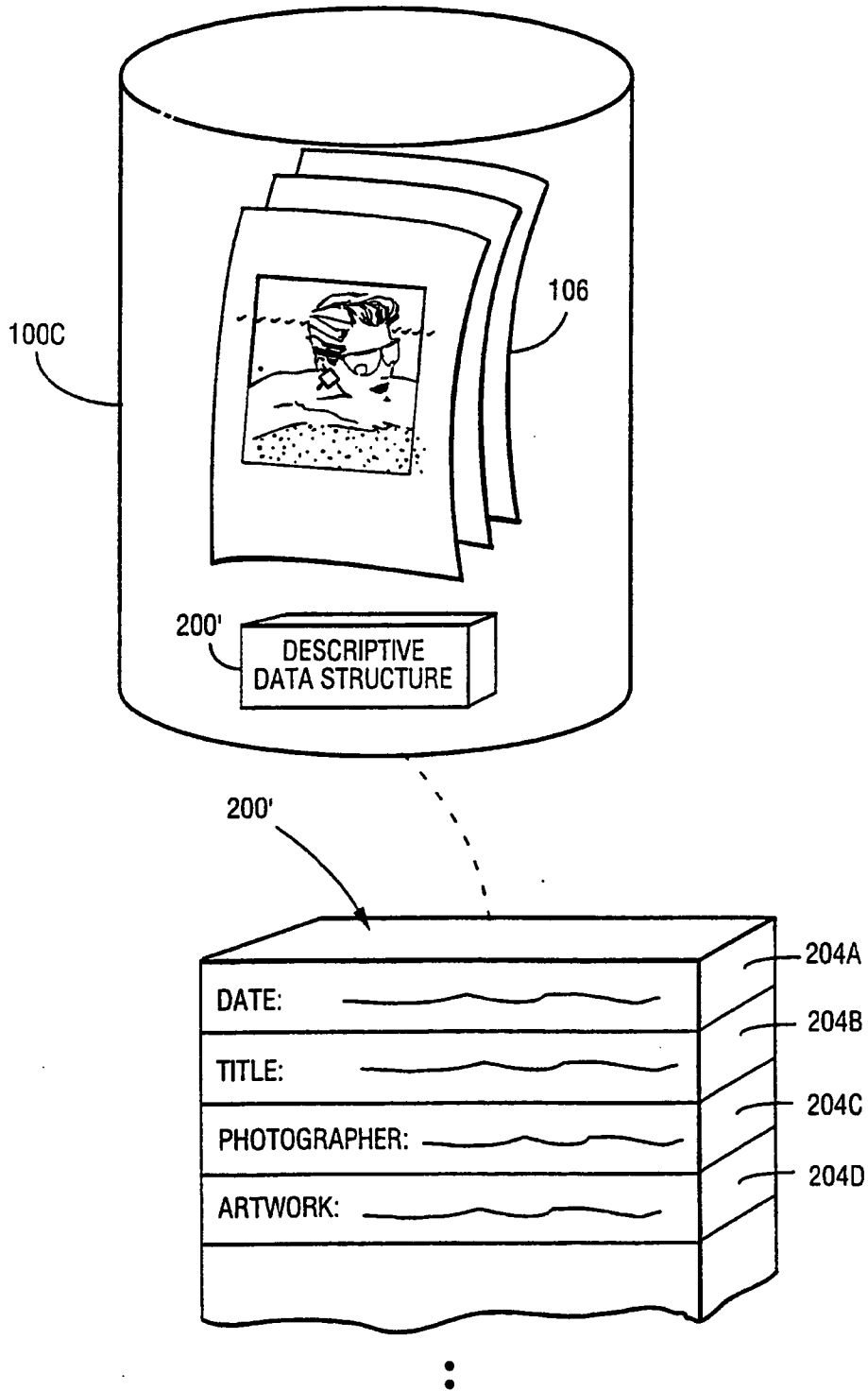


**Fig. 2A**  
Example Descriptive  
Data Structure



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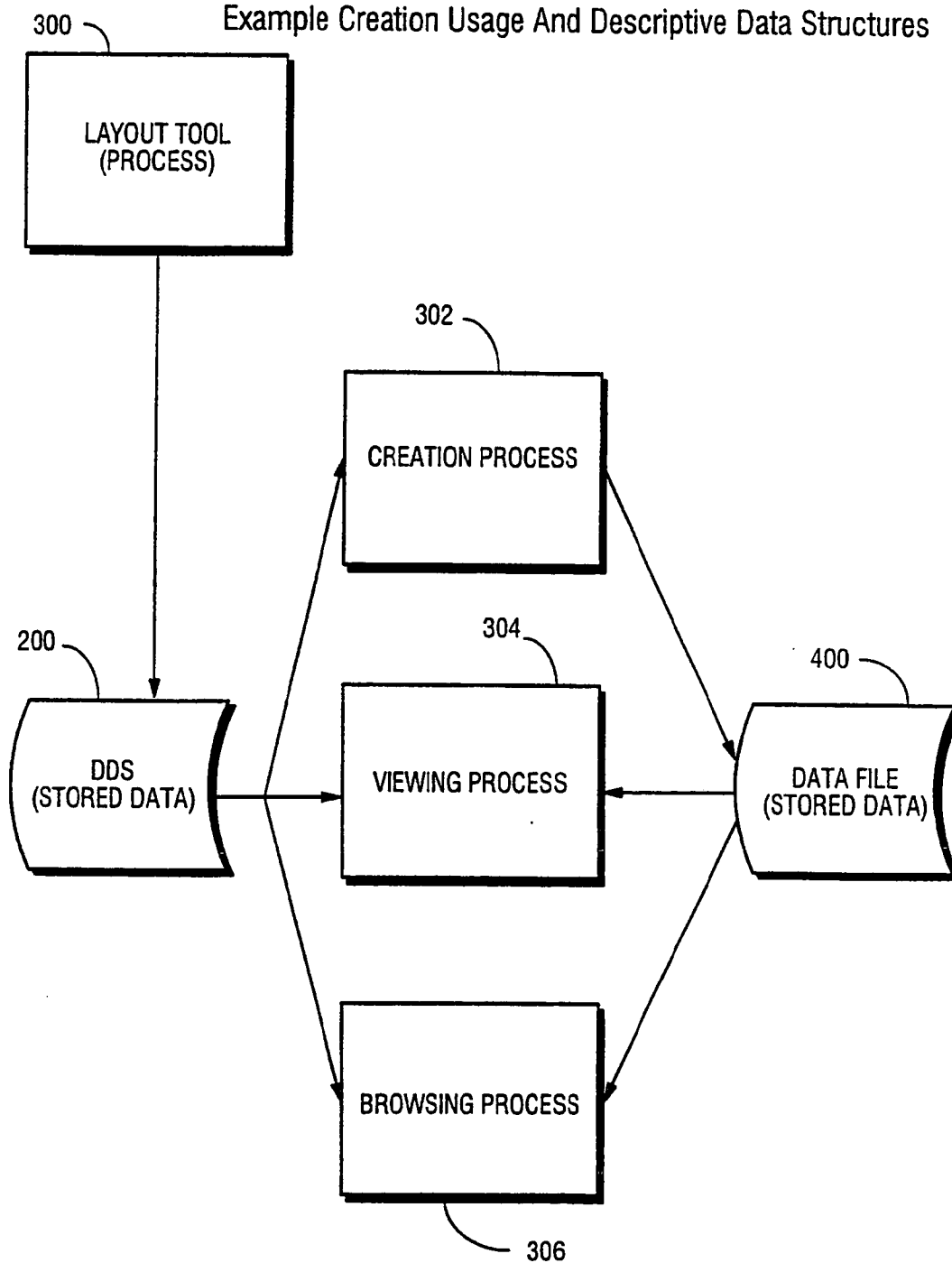
**Fig. 2B** Example Descriptive Data Structure

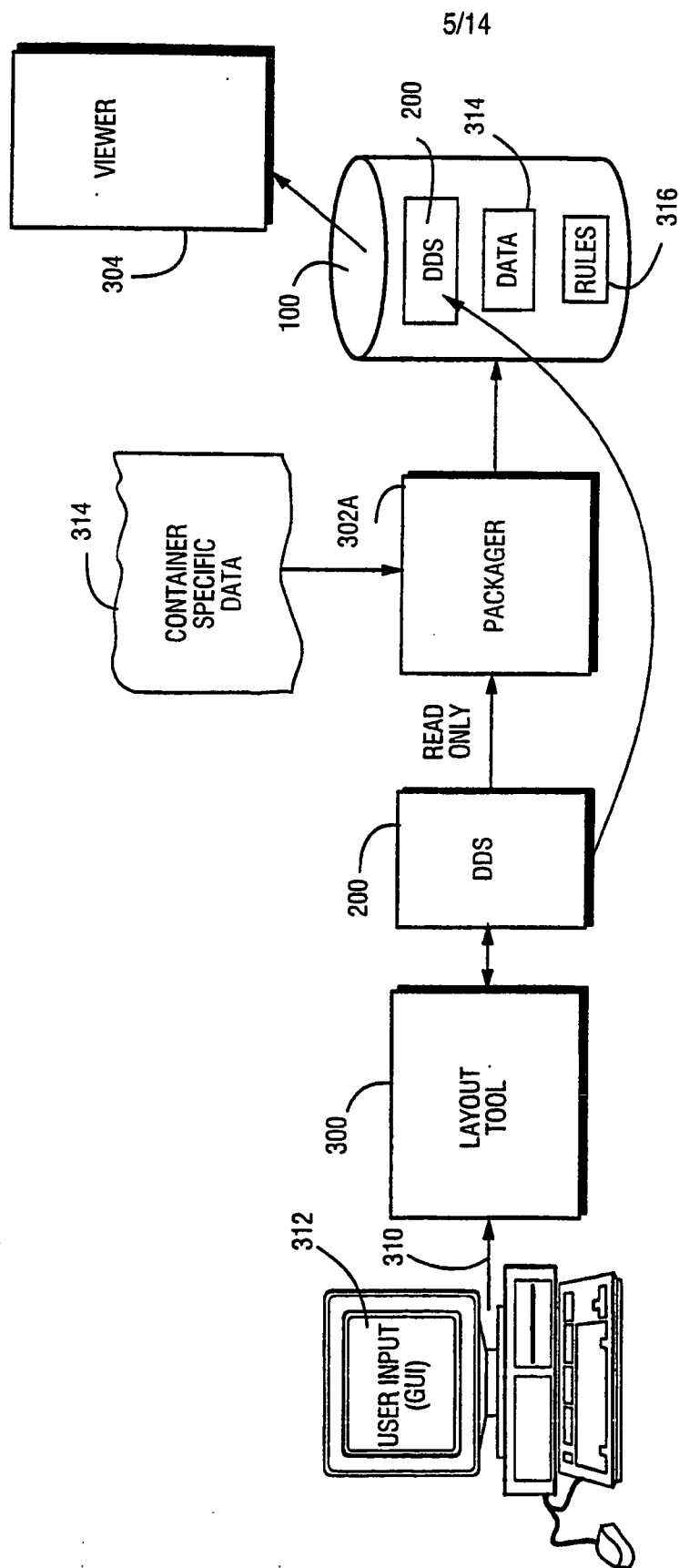


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**Fig. 3**

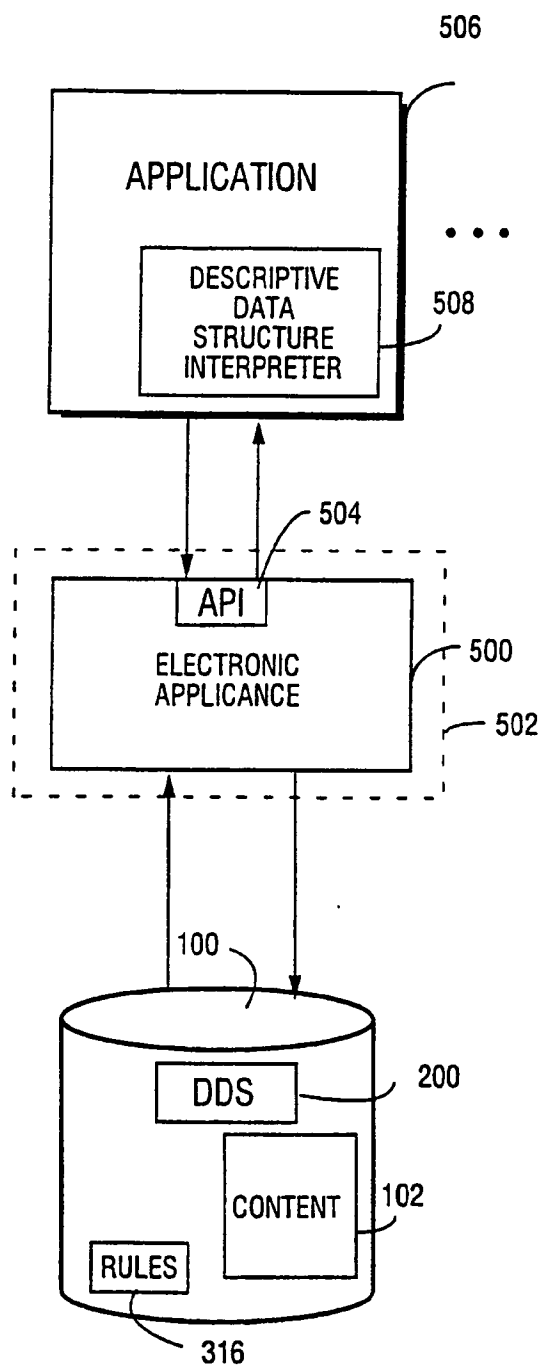
Example Creation Usage And Descriptive Data Structures





**Fig. 4** Example Template Creation And Usage

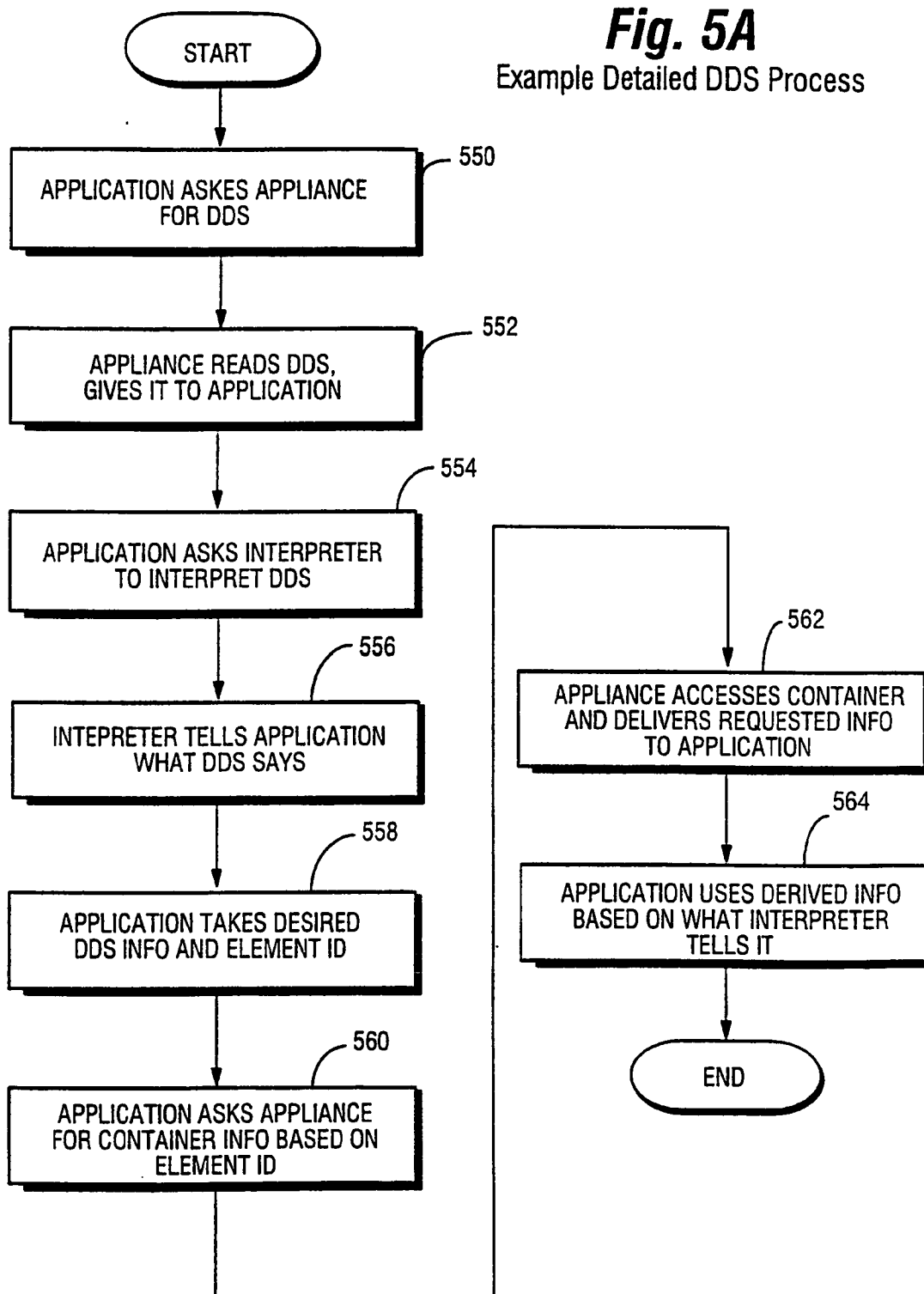
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**Fig. 5** Example Secure System Architecture

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**Fig. 5A**

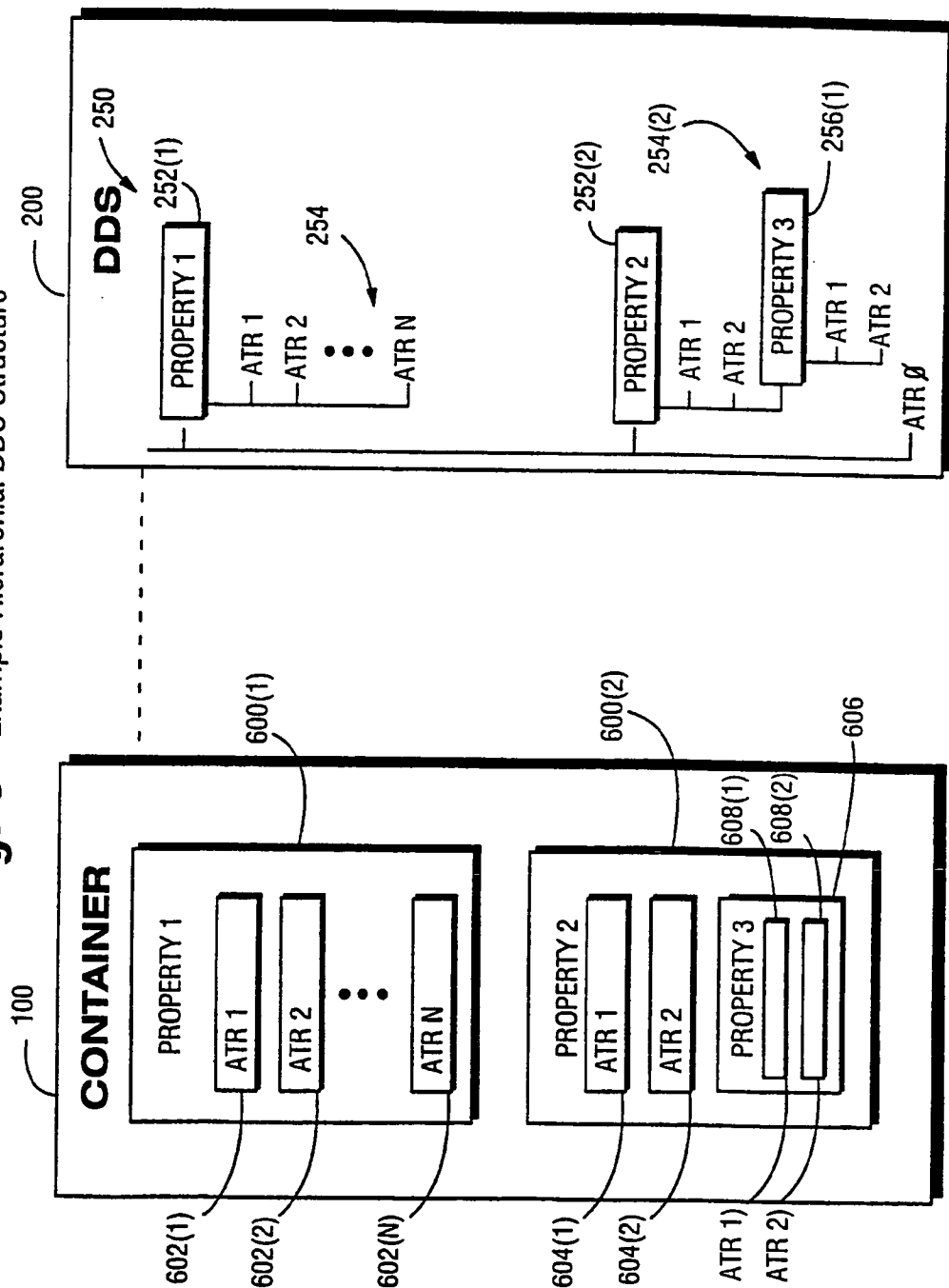
Example Detailed DDS Process





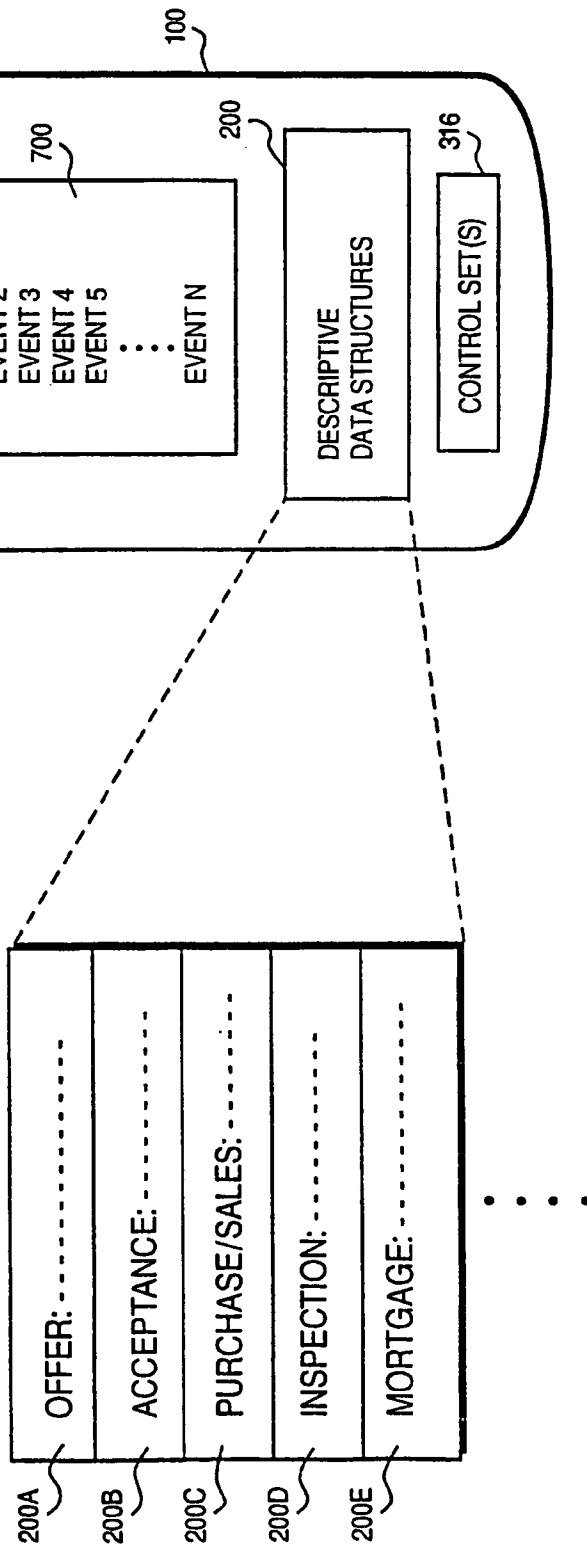
8/14

**Fig. 6** Example Hierarchical DDS Structure

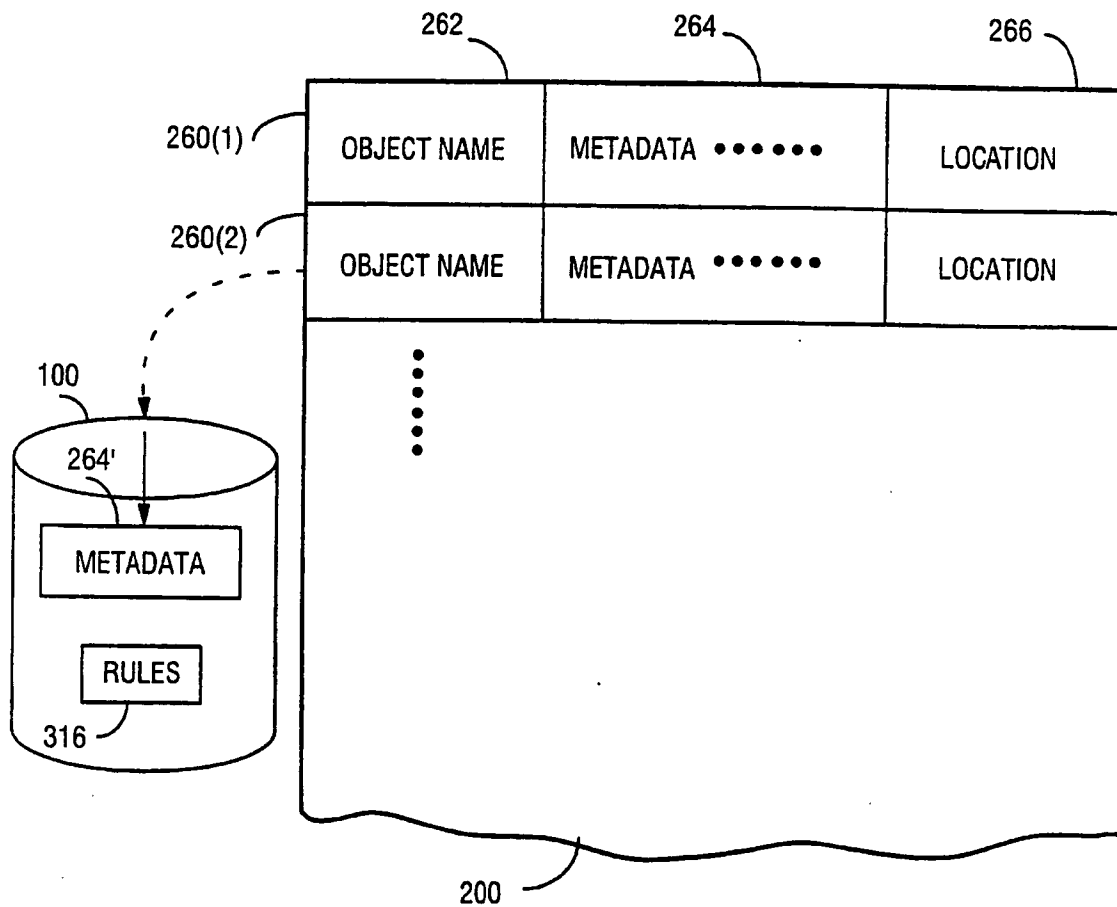


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**Fig.6A** DDS Supports Atomic Events

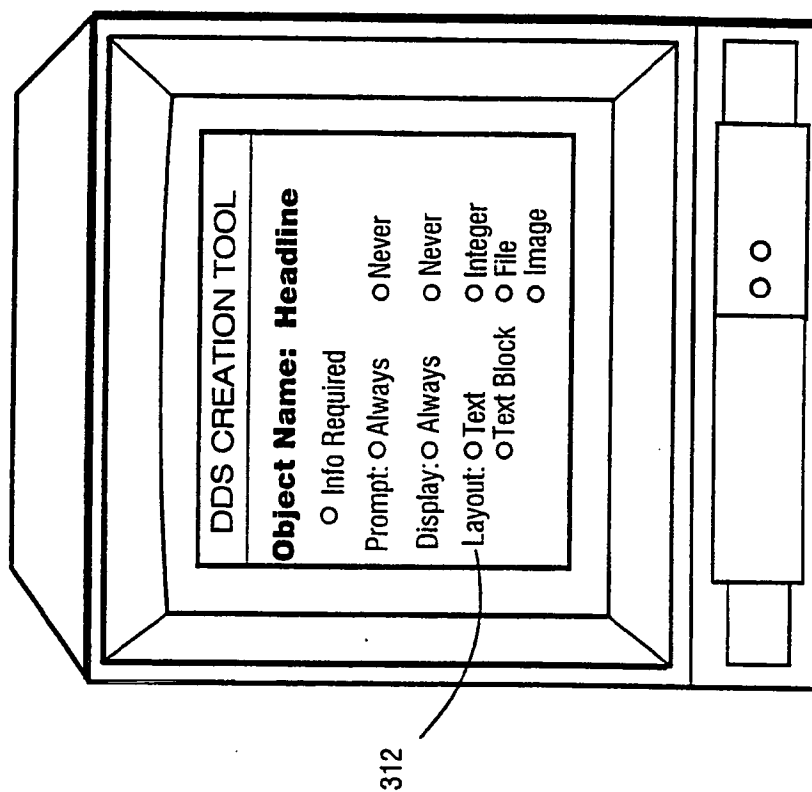


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**Fig. 7** Example Descriptive Data Structure Format

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**Fig. 8** Example DDS Creation Graphics Interface



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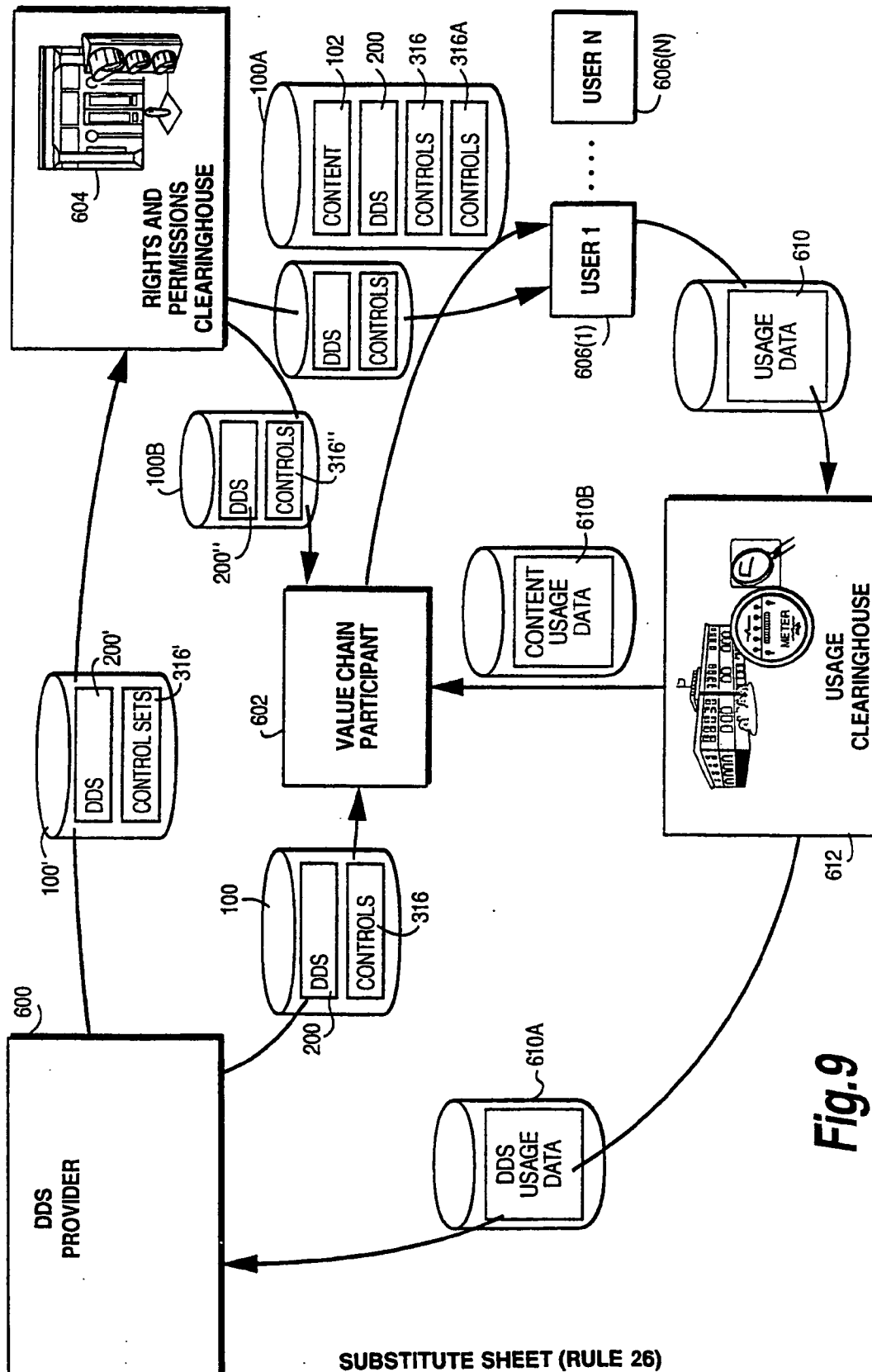
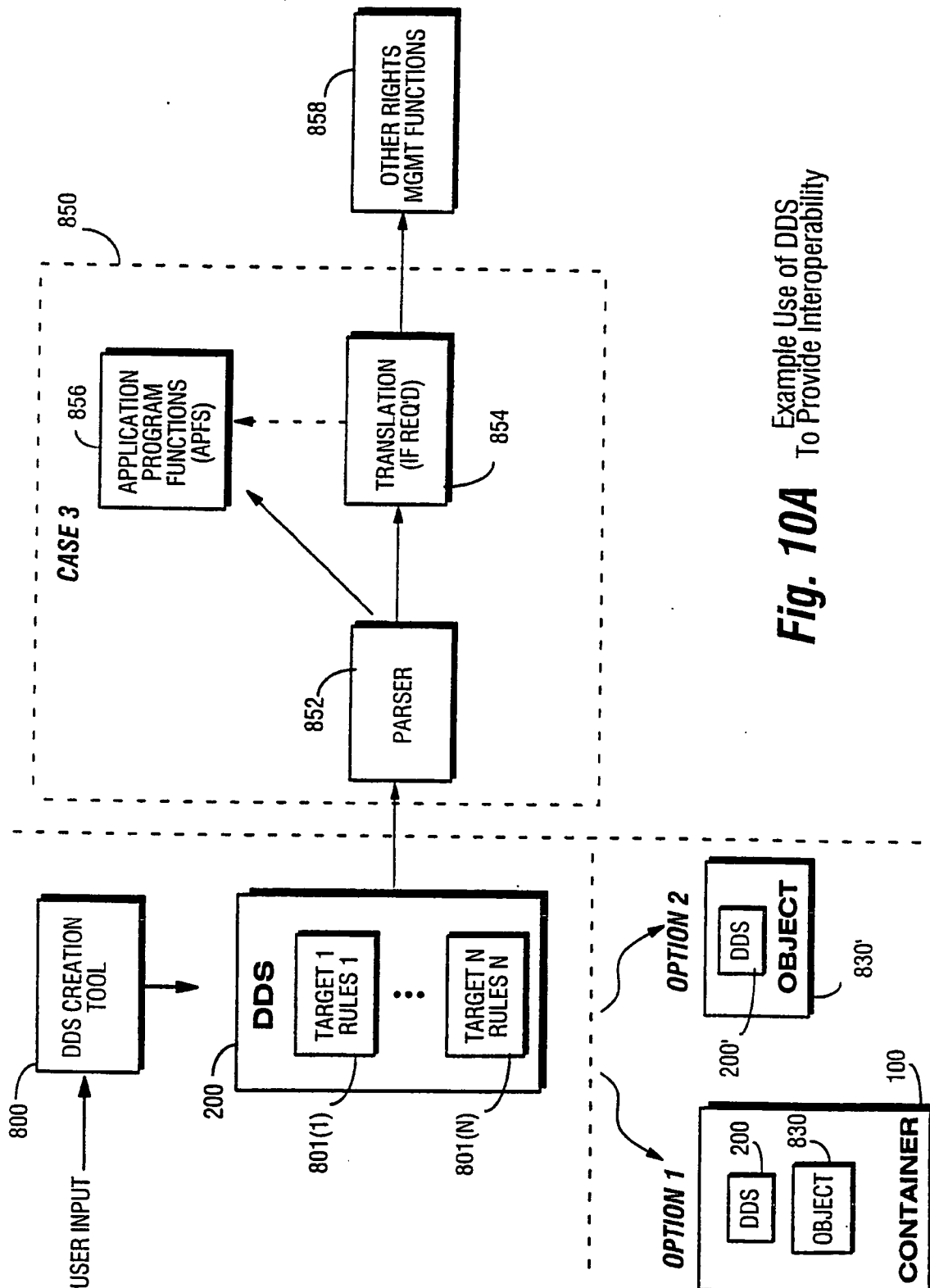
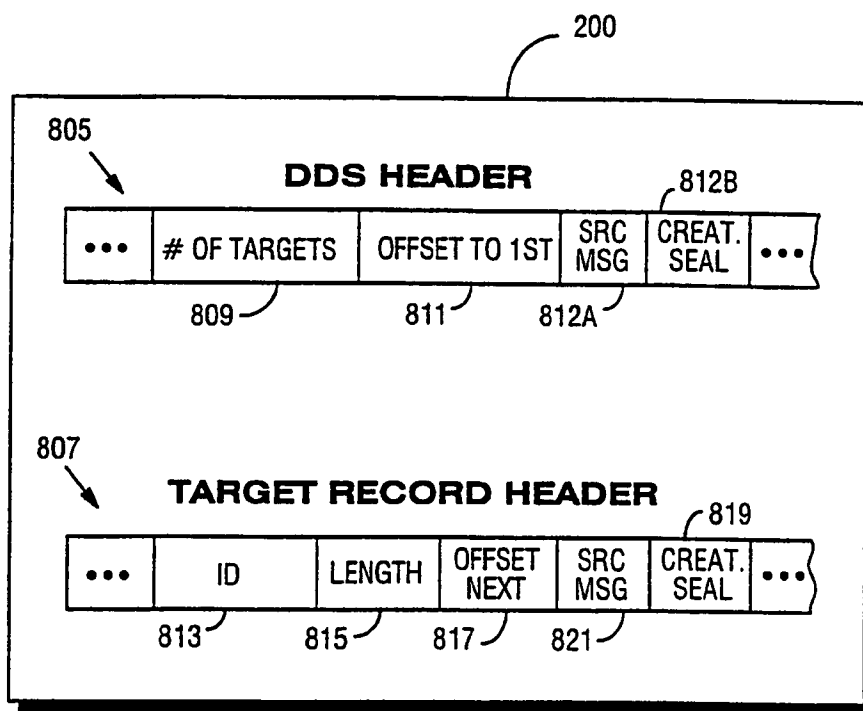


Fig. 9



**Fig. 10A** Example Use of DDS To Provide Interoperability

14/14



**Fig. 10B** Example DDS Structure

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/03623

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G06F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 398 645 A (IBM) 22 November 1990	1-5, 25, 27
Y	see abstract; figures 1,2,4,5	18
A	see column 2, paragraph 4 - column 5, last paragraph	6,8,9
X	EP 0 565 314 A (FISCHER ADDISON M) 13 October 1993	21
Y	see the whole document	18
A	EP 0 456 386 A (INT COMPUTERS LTD) 13 November 1991	1-28
	see the whole document	
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☒ Further documents are listed in the continuation of box C.

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A	<p>EP 0 570 123 A (FISCHER ADDISON M) 18</p> <p>November 1993</p> <p>see the whole document</p> <p>-----</p>	1-28

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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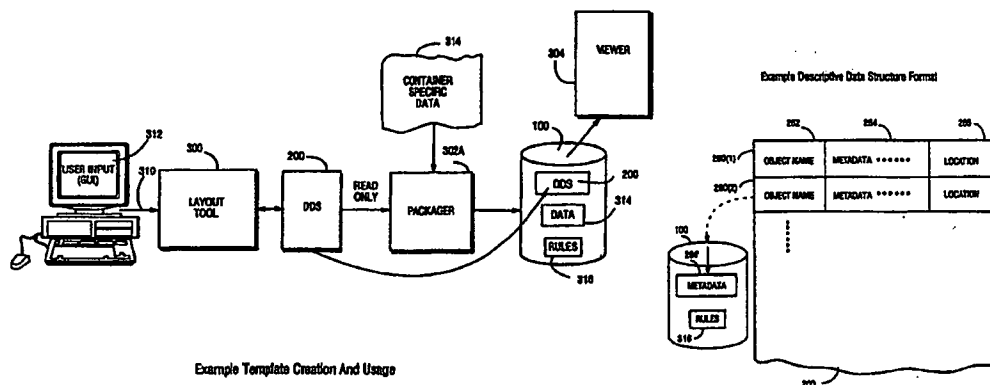
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>G06F 1/00</b>		<b>A1</b>	(11) International Publication Number: <b>WO 98/37481</b>
			(43) International Publication Date: 27 August 1998 (27.08.98)
(21) International Application Number: PCT/US98/03623 (22) International Filing Date: 25 February 1998 (25.02.98) (30) Priority Data: 08/805,804          25 February 1997 (25.02.97)          US (71) Applicant: INTERTRUST TECHNOLOGIES CORP. [US/US]; 460 Oakmead Parkway, Sunnyvale, CA 94086 (US). (72) Inventors: HALL, Edwin, J.; 5035 Country Lane, San Jose, CA 95129 (US). SHEAR, Victor, H.; 5203 Battery Lane, Bethesda, MD 20814 (US). TOMASELLO, Luke, S.; 204 Copco Lane, San Jose, CA 95123 (US). VAN WIE, David, M.; 1250 Lakeside Drive, Sunnyvale, CA 94086 (US). WEBER, Robert, P.; 215 Waverly Street #4, Menlo Park, CA 94025 (US). WORSENCROFT, Kim; 81 Reservoir Road, Los Gatos, CA 95032 (US). XU, Xuejun; 5839 Northland Terrace, Fremont, CA 94555 (US). (74) Agent: FARIS, Robert, W.; Nixon & Vanderhye P.C., 8th floor, 1100 North Glebe Road, Arlington, VA 22201-4714 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	

(54) Title: TECHNIQUES FOR DEFINING, USING AND MANIPULATING RIGHTS MANAGEMENT DATA STRUCTURES



## (57) Abstract

A descriptive data structure provides an abstract representation of a rights management data structure such as a secure container. The abstract representation may describe, for example, the layout of the rights management data structure. It can also provide metadata describing or defining other characteristics of rights management data structure use and/or processing. For example, the descriptive data structure can provide integrity constraints that provide a way to state rules about associated information. The abstract representation can be used to create rights management data structures that are interoperable and compatible with one another. This arrangement preserves flexibility and ease of use without compromising security.

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## **TECHNIQUES FOR DEFINING, USING AND MANIPULATING RIGHTS MANAGEMENT DATA STRUCTURES**

### **Field of the Invention**

5           This invention relates to techniques for defining, creating, and manipulating rights management data structures. More specifically, this invention provides systems and processes for defining and/or describing at least some data characteristics within a secure electronic rights management container. The present invention also provides  
10 techniques for providing rights management data structure integrity, flexibility, interoperability, user and system transparency, and compatibility.

### **Background and Summary of the Invention(s)**

          People are increasingly using secure digital containers to safely  
15 and securely store and transport digital content. One secure digital container model is the "DigiBox™" container developed by InterTrust Technologies Corp. of Sunnyvale California. The Ginter et al. patent specification referenced above describes many characteristics of this DigiBox™ container model -- a powerful,  
20 flexible, general construct that enables protected, efficient and interoperable electronic description and regulation of electronic commerce relationships of all kinds, including the secure transport, storage and rights management interface with objects and digital information within such containers.

Briefly, DigiBox containers are tamper-resistant digital containers that can be used to package any kind of digital information such as, for example, text, graphics, executable software, audio and/or video. The rights management environment in which DigiBox™

5 containers are used allows commerce participants to associate rules with the digital information (content). The rights management environment also allows rules (herein including rules and parameter data controls) to be securely associated with other rights management information, such as for example, rules, audit records created during

10 use of the digital information, and administrative information associated with keeping the environment working properly, including ensuring rights and any agreements among parties. The DigiBox™ electronic container can be used to store, transport and provide a rights management interface to digital information, related rules and

15 other rights management information, as well as to other objects and/or data within a distributed, rights management environment. This arrangement can be used to provide an electronically enforced chain of handling and control wherein rights management persists as a container moves from one entity to another. This capability helps

20 support a digital rights management architecture that allows content rightsholders (including any parties who have system authorized interests related to such content, such as content republishers or even governmental authorities) to securely control and manage content, events, transactions, rules and usage consequences, including any

25 required payment and/or usage reporting. This secure control and

management continues persistently, protecting rights as content is delivered to, used by, and passed among creators, distributors, repurposers, consumers, payment disaggregators, and other value chain participants.

- 5           For example, a creator of content can package one or more pieces of digital information with a set of rules in a DigiBox secure container -- such rules may be variably located in one or more containers and/or client control nodes -- and send the container to a distributor. The distributor can add to and/or modify the rules in the
- 10           container within the parameters allowed by the creator. The distributor can then distribute the container by any rule allowed (or not prohibited) means -- for example, by communicating it over an electronic network such as the Internet. A consumer can download the container, and use the content according to the rules within the
- 15           container. The container is opened and the rules enforced on the local computer or other InterTrust-aware appliance by software InterTrust calls an InterTrust Commerce Node. The consumer can forward the container (or a copy of it) to other consumers, who can (if the rules allow) use the content according to the same, differing, or other
- 20           included rules -- which rules apply being determined by user available rights, such as the users specific identification, including any class membership(s) (e.g., an automobile club or employment by a certain university). In accordance with such rules, usage and/or payment information can be collected by the node and sent to one or

more clearinghouses for payment settlement and to convey usage information to those with rights to receive it.

The node and container model described above and in the Ginter et al. patent specification (along with similar other

5 DigiBox/VDE (Virtual Distribution Environment) models) has nearly limitless flexibility. It can be applied to many different contexts and specific implementations. For example, looking at Figures 1A and 1B, a newspaper publisher can distribute a newspaper 102 within a container 100A. A publisher of fashion magazines 106 can distribute

10 the fashion magazines within another container 100C. Similarly, for example, a wholesale banking environment may use yet a further container, an electronic trading system may use a still further container, and so on.

The InterTrust DigiBox container model allows and facilitates

15 these and other different container uses. It facilitates detailed container customization for different uses, classes of use and/or users in order to meet different needs and business models. This customization ability is very important, particularly when used in conjunction with a general purpose, distributed rights management

20 environment such as described in Ginter, et al. Such an environment calls for a practical optimization of customizability, including customizability and transparency for container models. This customization flexibility has a number of advantages, such as allowing optimization (e.g., maximum efficiency, minimum

25 overhead) of the detailed container design for each particular



application or circumstance so as to allow many different container designs for many different purposes (e.g., business models) to exist at the same time and be used by the rights control client (node) on a user electronic appliance such as a computer or entertainment device.

5           While supporting a high degree of flexibility has great advantages, it can produce difficulties for the average user. For example, think of the process of creating a painting. A master painter creates a painting from a blank canvas. Because the canvas was blank at the beginning, the painter was completely unconstrained. The  
10       painting could have been a landscape, a portrait, a seascape, or any other image -- limited only by the painter's imagination. This flexibility allows a master painter to create a masterpiece such as the "Mona Lisa." However, great skill is required to create a pleasing image starting from a blank canvas. As a result, an inexperienced  
15       painter cannot be expected to create a good painting if he or she begins with a blank canvas.

          Consider now an amateur painter just starting out. That person does not have the skill to transform a blank canvas to a pleasing image. Instead of spending years trying to acquire that skill, the  
20       amateur can go out and buy a "paint by numbers" painting kit. Instead of using a blank canvas, the amateur painter begins with a preprinted canvas that defines the image to be painted. By following instructions ("all areas labeled "12" should be painted with dark red,"  
"all areas labeled with "26" should be painted with light blue"), the  
25       amateur can -- with relatively little skill -- paint a picture that is

relatively pleasing to the eye. To do this, the amateur must rigidly adhere to the preprinted instructions on the canvas. Any deviations could cause the final image to come out badly.

Ease of use problems in the computer field can be analogized to the “paint by numbers” situation. If it is important for untrained and/or inexperienced users to use particular software, the system designers can predefine certain constructs and design them into the system. This technique allows inexperienced users to make use of potentially very complicated designs without having to fully understand them – but this normally strictly defines, that is severely limits, the functionality and flexibility available by use of the program. As a result, creative solutions to problems are constrained in order to provide practical value. In addition, even the experienced user can find great advantage in using previously implemented designs. Because a user can program a complex program, for example, does not mean it is appropriate or efficient to create a program for a specific purpose, even if the previously implemented program is not ideal. If the creation of a new program “costs” more to create, that is takes too much time or financial resources, the experienced user will normally use a previously implemented program, if available. Therefore, the greatest total amount of value to be realized, related to customization, is to be able to customize with great ease and efficiency so that the cost of customization will not exceed the benefits.

Uniformity, flexibility, compatibility and interoperability are other considerations that come into play in the computer field, particularly in regards to systems supporting customization. In the painting situation, the human eye can appreciate uniqueness – and the “one of a kind” nature of a masterpiece such as the Mona Lisa is a big part of what makes a painting so valuable. In contrast, it is often desirable to make uniform at least the overall layout and format of things in the computer field. It is much more efficient for a computer to know beforehand how to treat and use objects. If the computer doesn’t know beforehand how to read or handle an input object, for example, then the computer and the object are said to be “incompatible”, i.e., they cannot work together. Computers are said to be “interoperable” if they can work together. Incompatibility and interoperability problems can prevent one computer from talking to another computer, and can prevent you from using computer data created by someone else.

For example, in the non-computer world, a Frenchman who knows only a little English as a second language, might find it far more meaningful and efficient to describe a complex problem in his native tongue, French. But if he is speaking to a second person, an Englishman, and the Englishman does not understand French, the two are not interoperable in French, and the Frenchman must resort to the far less efficient option of speaking in English to the Englishman. Of course, this is far better than if he was trying to speak to a German who understood neither English nor French. Then the two would be

not be “interoperable” in regards to discussing the problem.  
Similarly, because rights management containers may potentially be  
exchanged and used for a large number of different purposes by a  
large number of different users, groups, and organizations, it is very  
5 important to provide compatibility and interoperability if these  
different parties, each participating in one or more different rights  
management models, are to interoperate efficiently. For example, if a  
rights management container is used to distribute a newsletter and is  
optimized for this purpose, each reader of the newsletter must have a  
10 computer system or software that “knows” how to read the container  
and the newsletter it contains. Since commerce, such as distributing  
newsletters, needs to be as efficient and cost-effective as is feasible, it  
is important to optimize, that is customize, rights management  
containers to optimally reflect the requirements of their models and  
15 not to have unnecessary features for each respective application or  
class of application, since unnecessary features will require  
unnecessary computing overhead and/or storage space.

Different newsletter publishers may use different container  
formats customized to their own particular newsletters and/or content  
20 types and/or formats. A newsletter reader interested in many different  
newsletters may need to be able to read a large number of different  
formats. It normally will not efficient (or, due to security issues, may  
not be appropriate) simply to analyze the different containers upon  
delivery and “try to figure out” or otherwise discern the particular  
25 format in use.

Published standards may help achieve a level of interoperability and standards for given types of applications, but it generally takes a long time for any particular standard to achieve industry-wide acceptance and standards will need to vary widely between categories of applications. Moreover, data structure and other standards are often designed to the lowest common denominator -- that is, they will carry fields and requirements not needed by some, and miss others features optimal in certain cases. There will always be applications that cannot be optimized for efficiency and/or operation if forced to use a specific standard.

Trade-offs between flexibility, ease of use and incompatibility and interoperability can be further complicated when security considerations come into play. To be effective in many electronic commerce applications, electronic container designs should be tamper-resistant and secure. One must assume that any tools widely used to create and/or use containers will fall into the hands of those trying to break or crack open the containers or otherwise use digital information without authorization. Therefore, the container creation and usage tools must themselves be secure in the sense that they must protect certain details about the container design. This additional security requirement can make it even more difficult to make containers easy to use and to provide interoperability.

The above-referenced Ginter et al. patent specification describes, by way of non-exhaustive example, "templates" that can act as a set (or collection of sets) of control instructions and/or data

for object control software. See, for example, the "Object Creation and Initial Control Structures," "Templates and Classes," and "object definition file," "information" method and "content" methods discussions in the Ginter et al. specification. The described templates are, in at least some examples, capable of creating (and/or modifying) objects in a process that interacts with user instructions and provided content to create an object. Ginter et al. discloses that templates may be represented, for example, as text files defining specific structures and/or component assemblies, and that such templates -- with their structures and/or component assemblies -- may serve as object authoring and/or object control applications. Ginter et al. says that templates can help to focus the flexible and configurable capabilities inherent within the context of specific industries and/or businesses and/or applications by providing a framework of operation and/or structure to allow existing industries and/or applications and/or businesses to manipulate familiar concepts related to content types, distribution approaches, pricing mechanisms, user interactions with content and/or related administrative activities, budgets, and the like. This is useful in the pursuit of optimized business models and value chains providing the right balance between efficiency, transparency, productivity, etc.

The present invention extends this technology by providing, among other features, a machine readable descriptive data structure for use in association with a rights management related (or other) data structure such as a secure container. In one example, the machine

readable descriptive data structure may comprise a shorthand abstract representation of the format of the data within a rights management related data structure. This abstract data representation can be used to describe a single rights management data structure, or it may be  
5 generic to a family of data structures all following the format and/or other characteristics the abstract representation defines. The abstract representation may be used to create rights management data structures, allow others (including "other" rights management nodes automatically) to read and understand such data structures, and to  
10 manipulate some or all of the data structures.

The descriptive data structure can be used as a "template" to help create, and describe to other nodes, rights management data structures including being used to help understand and manipulate such rights management data structures.

15 In one particularly advantageous arrangement, the machine readable descriptive data structure may be associated with one or a family of corresponding rights management data structures – and may thus be independent of any specific particular rights management data structure usage. For example, a copy of the descriptive data structure  
20 may be kept with such data structures. Alternatively, some or all of the descriptive data structure may be obtained from somewhere else (e.g., a clearinghouse or repository) and independently delivered on as-needed basis.

In accordance with one example, the machine readable  
25 descriptive data structure provides a description that reflects and/or

defines corresponding structure(s) within the rights management data structure. For example, the descriptive data structure may provide a recursive, hierarchical list that reflects and/or defines a corresponding recursive, hierarchical structure within the rights management data structure. In other examples, the description(s) provided by the descriptive data structure may correspond to complex, multidimensional data structures having 2, 3 or n dimensions. The descriptive data structure may directly and/or indirectly specify where, in an associated rights management data structure, corresponding defined data types may be found. The descriptive data structure may further provide metadata that describes one or more attributes of the corresponding rights management data and/or the processes used to create and/or use it. In one example, the entire descriptive data structure might be viewed as comprising such metadata.

The machine readable descriptive data structure may or may not be, in part or in whole, protected, depending on the particular application. Some machine readable descriptive data structures may be encrypted in whole or in part, while others might be maintained in "clear" form so that they are easily accessible. Some machine readable description data structures, whether encrypted or not, may be in part or wholly protected for integrity using a cryptographic hash algorithm in combination with a secrecy algorithm to form a cryptographic seal, and/or through use of other protection techniques (including hardware, e.g., secure semiconductor and/or hardware



packaging protection means). The machine readable descriptive data structures may themselves be packaged within rights management data structures, and rules (e.g., permissions records) controlling their access and use may be associated with them

5           In accordance with one aspect of how to advantageously use descriptive data structures in accordance with a preferred embodiment of this invention, a machine readable descriptive data structure may be created by a provider to describe the layout of the provider's particular rights management data structure(s) such as secure  
10   containers. These descriptive data structure ("DDS") templates may be used to create containers. A choice among two or more possible DDSs may be based upon one or more classes and/or one or more classes may be based on parameter data. The DDS may be loaded and used as the layout rules for secure containers being created. The  
15   provider can keep the DDS private, or publish it so that other providers may create compatible, interoperable containers based on the same DDS.

          Descriptive data structures can also be used by a container viewer, browser, reader, or any other end user application designed to  
20   work with containers. Truly generic viewers or other applications can be written that can process a container in any format at least in part by making use of descriptive data structures. Thus, a descriptive data structure can be used to at least temporarily convert and/or customize a generic viewer (or other application) into a specialized viewer (or  
25   other application) optimized around one or more classes of

containers. Additionally, specialized readers may be provided to efficiently process descriptive data structures to locate key media elements (e.g., cover page, table of contents, advertiser's index, glossary, articles, unprotected preview, price, and/or rights information regarding viewing, printing, saving electronically, redistributing, related budgets and/or other parameter information, etc.).

Such specialized readers can then seamlessly, transparently, and automatically process to present the user with an easy-to-use interface (for example, an icon display for each of the key media elements) optimized for the specific application, container, and/or user. Different and/or differently presented, such elements may be displayed or otherwise employed based, for example, on the identity of the user and/or user node, including, for example, taking into account one or more class attributes which can influence such automated processing.

Two or more DDSs may be associated with a container and/or container contents, as well as, for example, one or more user and/or node classes. A choice among two or more possible DDSs for a given container and/or class of containers and/or container contents may therefore be based upon one or more classes and/or one or more classes based on parameter data. Overall, this ability to easily characterize, and/or reuse stored, optimized, custom container models and subsequent transparency of translation from such customized containers (e.g., specific DDSs) to general purpose rights

- management use is particularly useful. For example, where such customized DDSs can be used as a basis for the creation of customized, optimized display of container content and/or control information to substantially improve the ease of use, efficiency, transparency, and optimization of a distributed, generalized rights management environment. In such an environment, for example, user nodes can interact with different DDSs to automatically adjust to the requirements of the commercial or other rights models associated with such DDSs.
- 10        Some providers may spend considerable time designing sophisticated container descriptive data structures that describe the layout of their associated containers. With this type of investment in structure and format, the descriptive data structure will often have significant value in their reuse for the same or similar applications.
- 15        Entities can use descriptive data structures in-house to ensure consistent and highly efficient creation of containers. Third party providers (i.e., a provider other than the one responsible for descriptive data structure creation) can use these descriptive data structures when they wish to create containers compatible with other
- 20        entities. One example is where the publisher of a widely circulated newspaper develops a descriptive data structure for reading its newspaper. Other, smaller newspapers may want to leverage any viewers or other tools put in place for use with the widely circulated newspaper by adopting the same container format. Descriptive data
- 25        structures can be copyrighted and/or otherwise protectable by both

law and by the rights management system itself. For example, they may also be protected by their own containers and associated controls to ensure that descriptive data structure creators, and/or distributors and/or other users of such DDSs, receive their fair, rights system managed, return on their descriptive data structure creation and/or use related efforts.

In addition to the foregoing, the following is a list of features and advantages provided in accordance with aspects of this invention:

- 10       • Integrity Constraints: The descriptive data structure allows the provider to protect the integrity of his or her content, by enabling the specification of integrity constraints. Integrity constraints provide a way to state integrity related rules about the content.
- 15       • Application Generation: The descriptive data structure can be used to generate one or more portions of software programs that manipulate rights management structures. For example, a descriptive data structure could serve as 'instructions' that drive an automated packaging application for digital content and/or an automated reader of digital content such as display priorities and organization (e.g.,  
20       order and/or layout).
- 25       • Dynamic user interfaces for creation applications: Applications can read a descriptive data structure to generate an interface optimized for data creation, editing, and/or composition for a specific model, including models

involving, for example, composing complex content from textual, audio, video, and interactive (e.g., querying) elements. The data may take the form of a container, database and/or any other digital information organization as any simple or compound and complex file format. Applications can also read a descriptive data structure to learn how to best display an interface for collection and/or creation of content.

- Dynamic user interfaces for display applications:

Applications can read a descriptive data structure to and generate an interface appropriate for data display. This data may be a container, database or any other compound complex file format. Applications can also read a descriptive data structure to learn how to best display an interface for the presentation of content. Applications can further read a descriptive data structure to learn how to manage display functions related to interacting -- for content creation and/or packaging and/or user display purposes including optimizing any of such interactions -- with other one or more other applications, smart agents, computing environments, identity (including any class identities) of user and/or user nodes, etc. For example, a user interface might be differently optimized for interacting with: a member of the U. S. Air Force versus a faculty member in social sciences at a university; or a member of a Kiwanis

Club versus a member of a Protestant church club, a citizen of the United States versus a citizen of Saudia Arabia, including an appropriate display of expected class membership symbols and related, appropriate organization or suppression of displayed information.

- Ability to automatically identify and locate data fields: Full text search, agents, web spiders, and the like, benefit and are able to interact with information contained within one or more areas of a DDS when areas within a data file are known to contain potentially interesting information and such information is presented in a predefined format.
- Ability to extract needed or desired data without first-hand knowledge of data format: Full text search, agents, web spiders, and the like, benefit and are able to interact with information contained within one or more areas of a DDS when large data files of arbitrary complexity and of unknown origin can be processed without special knowledge.
- Efficient, machine/human readable data abstract: The descriptive data structures can be optimally small, convenient, and cost-effective to process, transmit, and/or store.
- Reusable, salable – independent of actual data: Descriptive data structures may be arbitrarily complex and therefore potentially time consuming to construct and requiring

certain expertise. This gives the descriptive data structure resale value.

- On-the-fly definition and redefinition of content layout:

5 Working with a layout tool allows quick iterations (including editing and modifications) of a design (layout) which can be more convenient and cost-effective than creating such a layout, which also may be quite difficult or beyond the expertise of many users.

10 • Descriptive data structure attributes allow for meta-characteristics not found in actual data: Because the same descriptive data structure is processed by both the creation and post-creation processes, meta-information can be placed into the descriptive data structure that would otherwise be unavailable in the packaged content. One example of this whether display of certain fields is “Required” or “Hidden”.

15 • Enables design automation via descriptive data structure “wizards”: Descriptive data structures themselves enable further automation in the way of “wizards”. There can, for example, be descriptive data structures that help to define other descriptive data structures. Descriptive data structures defining other descriptive data structures might represent the incomplete descriptive data structure for a book or magazine, for example. The “wizard” can comprise a series of dialog boxes displayed to the user to fill in the missing

20

information to make it a completed descriptive data structure.

- Applications outside of a particular rights management architecture: For example, polymorphous applications may use descriptive data structures to determine certain data visualizations attributes and/or requirements, such as what look and feel should be displayed to the user. For example, if a descriptive data structure contains a word processing document reference, the polymorphous application might create an interface appropriate for display and editing of a document. If the descriptive data structure contains references to many executable programs, the polymorphous application might ask the user where the files should be saved.
- Enables umbrella applications to process descriptive data structures and delegate unknown file types and processes: Umbrella (or polymorphous) applications can, for example, act substantially as an operation for a particular data file. This umbrella application may extract and process those things in the data file that it cares about, while ignoring or delegating (to, for example, user and/or value chain partner (e.g., distributor) to control display of such items) those things it does not understand.



- Runtime interpretation: It is possible to interpret a descriptive data structure at run time, providing materially increased efficiencies and timeliness.
- 5     • Runtime adaptability: Systems can adapt to dynamic data arriving in real time through use of descriptive data structures.
- Automatic conversion capability: Descriptive data structures be used for converting automatically from one format to another.
- 10    • Simplified system design: The use of descriptive data structures may greatly reduce the need for a secondary “wrapper” application programming interface (API) or other arrangement to securely “contain” the container creation process. Such a “wrapper” API to control and otherwise  
15     restrict the container creation process might otherwise be needed to ensure that all created containers are compatible – thereby limiting flexibility and the ability to customize.
- Object oriented template programming environment: The use of display related, interaction related, and rights related  
20     concept objects which may be selected through high-level user interface choices and prioritizations and specification of related parameter data, this enabling very easy creation of certain categories of templates – such as construction and display hint information.

- The use of a template language and interpreter involving supporting programming through use of language elements and interpretation of such language by nodes described in Ginter, et al., where such language includes elements descriptive of display, rights, and program interaction elements, priorities and parameter data.

### **Brief Description of the Drawings**

These and other features and advantages of presently preferred example embodiments in accordance with the invention may be better and more completely understood by referring to the following detailed description along with the drawings, of which:

Figures 1A and 1B show example content containers;

Figures 2A and 2B show example content containers associated with example descriptive data structures;

Figure 3 shows an example descriptive data structures creation and usage process;

Figure 4 shows another example creation and usage process;

Figure 5 shows an example system architecture using descriptive data structures;

Figure 5A shows an example process performed by the Figure 5 system;

Figure 6 shows an hierarchical descriptive data structure organization;

Figure 6A shows an example of how descriptive data structures can be used with atomic transaction data;

Figure 7 shows an example descriptive data structure format;

Figure 8 shows an example descriptive data structure creation  
5 graphical interface;

Figure 9 shows an example process for tracking descriptive data structure rights management related data;

Figure 10A shows an example use of descriptive data structures to provide interoperability between environments; and

10 Figure 10B provides more detail about how the Figure 10A example descriptive data structure may be organized.

### **Detailed Description of Presently Preferred Example**

#### **Embodiments**

Figures 2A and 2B show the example containers 100a, 100c of  
15 Figures 1A, 1B associated with machine readable descriptive data structures 200 and 200'. Referring to Figure 2A, a descriptive data structure 200 is associated with content container 100a. This descriptive data structure 200 may be used to define the content (and certain other characteristics) of container 100a. In the example  
20 shown, descriptive data structure 200 defines a number of sections of newspaper style content 102 such as, for example, the headline (descriptor 202a), the issue date (descriptor 202b), the lead story (descriptor 202c), breaking news (descriptor 202d), image(s)

(descriptor 202e), advertisement (descriptor 202f), and section (descriptor 202g).

The descriptive data structure definitions 202 in this example do not contain or specify the particular contents of corresponding portions of the newspaper 102, but instead define more abstractly, a generic format that a newspaper style publication could use. For example, the Figure 2A example descriptive data structure headline definition 202a does not specify a particular headline (e.g., "Yankees Win the Pennant!"), but instead defines the location (for example, the logical or other offset address) within the container data structure 100a (as well as certain other characteristics) in which such headline information may reside. Because descriptive data structure 200 is generic to a class or family of newspaper style content publications, it can be reused. For example, each daily issue of a newspaper might be created using and/or associated with the same descriptive data structure 200. By abstractly defining the data format and other characteristics of newspaper style content 102, the descriptive data structure 200 allows easy creation, usage and manipulation of newspaper style content 102.

Referring to Figure 2B, a different descriptive data structure 200' may be used to define another class of content publications 106 such as fashion magazines. The descriptive data structure 200' for this content class reflects a different format (and possibly other characteristics) as compared to the descriptive data structure 200 shown in Figure 2A. For example, since fashion magazines typically

do not include headlines or breaking news, the example descriptive data structure 200' may not define such formatting. Instead, descriptive data structure 200' for defining a class of fashion magazine content may define issue date (descriptor 204a), a magazine title (descriptor 204b), the name of a photographer (descriptor 204c) and associated artwork designation (descriptor 204d).

The Figure 2A and 2B examples show descriptive data structures 200, 200' being delivered within content object containers 100a, 100c along with associated content 102, 106. However, other forms of association may be used. For example, descriptive data structure 200 can be independently delivered in its own separate container along with associated rules controlling its access and/or use. Alternatively, descriptive data structures 200 could be stored in a library and delivered on an as needed basis in secure or insecure form depending on particular requirements.

In addition, although Figures 2A and 2B are printed publication content examples, the use of descriptive data structures 200 is not so limited. To the contrary, descriptive data structures 200 can be used to define the format and/or other characteristics associated with a wide variety of different types of digital information including for example:

- images
- sound
- video

- computer programs
- methods
- executables
- interpretables
- 5 • currency objects
- currency containers for currency objects
- rules
- any computer input
- any computer output
- 10 • other descriptive data structures
- any other information.

### **Example Process For Creating and Using Descriptive Data Structures**

Figure 3 shows an example process for creating and using  
15 descriptive data structures 200. In this example, a layout tool 300 is  
used to create descriptive data structure 200. This layout tool 300  
may be, for example, a software-controlled process interacting with a  
human being via a graphical user interface. The resulting descriptive  
data structure 200 (which may be stored on a mass storage device or  
20 other memory) can then be used to facilitate any number of other  
processes to create or interpret stored data. For example, the  
descriptive data structure may be used in a creation process 302. The  
creation process 302 may read the descriptive data structure and, in  
response, create an output file 400 with a predefined format such as,

for example, a container 100 corresponding to a format described by the descriptive data structure 200. A viewing process 304 may use the descriptive data structure 200 to locate important items in the output file 400 for display. A browsing process 306 may use the  
5 descriptive data structure 200 to locate items within the stored output file 400 such as, for example, key words or other searchable text. Descriptive data structure 200 may supply integrity constraints or rules that protect the integrity of corresponding content during use of and/or access to the content.

10           Figure 4 shows a more detailed example descriptive data structure creation and usage process. In this example, the layout tool 300 may accept user input 310 provided via a graphical user interface 312. The output of the layout tool 300 may be a descriptive data structure 200 in the form of, for example, a text file. A secure  
15 packaging process 302a may accept container specific data as an input, and it may also accept the descriptive data structure 200 as a read only input. The packager 302a could be based on a graphical user interface and/or it could be automated. The packager 302a packages the container specific data 314 into a secure container 100.  
20 It may also package descriptive data structure 200 into the same container 100 if desired. A viewer 304 may view data 314 with the assistance of the descriptive data structure 200 and in accordance with rules 316 packaged within the container applying to the data 314 and/or the descriptive data structure 200.

### **Example Architecture For Using Descriptive Data Structures**

Figure 5 shows an example secure system architecture suitable for use with descriptive data structure 200. In this example, an  
5 electronic appliance 500 of the type described in the above-referenced Ginter et al. patent specification may be provided within a tamper resistant barrier 502. Electronic appliance 500 may include an application program interface (API) 504. One or more applications 506 may communicate with electronic appliance 500 via API 504. In  
10 some examples, the application 506 may execute on the secure electronic appliance 500. Each application 506 may include a descriptive data structure interpreter 508. In use, electronic appliance 500 may access secure container 100 and – in accordance with rules 316 – access the descriptive data structure 200 and content 102 it  
15 contains and provide it to application 506. The interpreter 508 within application 506 may, in turn, read and use the descriptive data structure 200. In addition, application 506 may be polymorphic in the sense that it can take on personality or behavior as defined at least in part by descriptive data structure 200..

20 Figure 5A shows an example detailed process performed by the Figure 5 example secure system architecture. In this example, application 506 asks appliance 500 to retrieve the descriptive data structure 200 from container 100 (block 550). Electronic appliance 500 reads the descriptive data structure 200 and, subject to the  
25 conditions specified by associated rules 316, provides the descriptive



data structure 200 to the application 506 (block 552). Application 506 then asks its interpreter 508 to interpret the descriptive data structure 200 (block 554). The interpreter 508 tells the application 506 what the descriptive data structure 200 says (block 556). The  
5 application 506 extracts or obtains the descriptive data structure information it needs or wants from interpreter 508 (block 558). For example, suppose the application 506 wants to display the "headline" information within newspaper style content shown in Figure 2A. Application 506 may ask interpreter 508 to provide it with  
10 information that will help it to locate, read, format and/or display this "headline" information.

As another example, interpreter 508 may provide application 506 with an element identification (e.g., a hexadecimal value or other identifier) that corresponds to the headline information within the  
15 newspaper style content (block 558). Application 506 may then ask electronic appliance 500 to provide it with the Headline (or other) content information 102 within container 100 by providing appropriate content information to electronic appliance 500 via API 504 (block 560). For example, application 506 may pass the  
20 electronic appliance 500 the element ID that interpreter 508 provided to the application. Even though application 506 may have no direct knowledge of what is inside container 100 (and may only be able to access the container 100 through a secure VDE node provided by appliance 500), interpreter 508 (by looking at descriptive data  
25 structure 200) can tell application 506 enough information so that the

application knows how to request the information it wants from the electronic appliance 500.

The electronic appliance may then access information 102 within container 100, and deliver (in accordance with the rules 316 within the container) the requested information to the application 506 (block 562). The application 506 may then use the information electronic appliance 500 provides to it, based at least in part on what interpreter 508 has told it about the content information (block 564). For example, the descriptive data structure 200 may provide characteristics about the way application 506 should handle the information 102. Descriptive data structure 200 can, for example, tell application 506 to always display a certain field (e.g., the author or copyright field) and to never display other information (e.g., information that should be hidden from most users). DDS 200 can also provide complete presentation or "visualization" information so that an information provider can, for example, control the look and feel of the information when it is displayed or otherwise rendered. Descriptive data structure 200 may provide encodings of other characteristics in the form of metadata that can also be used by application 506 during a process of creating, using or manipulating container 100. The DDS 200 can be used to generate a software program to manipulate rights management structures. For example, a DDS 200 could serve as the 'instructions' that drive an automated packaging application for digital content or an automated reader of digital content.

### **Example Description(s) Provided by Descriptive Data Structure**

Figure 6 shows one example of how a descriptive data structure 200 may describe and define an arbitrarily complex, information structure such as, for example, an hierarchical container 100. In this particular example, container 100 includes properties 600(1), 600(2). Property 600(1) may include n attributes 602(1), 602(2) ... 602(n). Property 600(2) may include any number of attributes 604(1), 604(2), and it may also include an additional property 606. Property 606 may, in turn, include its own attributes 608(1), 608(2) ... . Associated descriptive data structure 200 may be organized as a tree structure list 250 providing a recursive structure to reflect the recursive structure of the contents of container 100. For example, list 250 may include "branches" in the form of "property" descriptors 252(1), 252(2) corresponding to properties 600(1), 600(2). Each property descriptor 252 may, in turn, include a list 254 of attributes and may include additional property descriptors 256 in the same recursive, hierarchical arrangement as is reflective of the example content container structure. DDS 200 may be used to describe arbitrarily complex, hierarchical or non-hierarchical data structures of any dimension (1 to n).

Figure 6A shows that descriptive data structure 200 can be used in conjunction with any kind of information such as, for example, events or methods defining an "atomic transaction" such as a real estate transaction. In this Figure 6A example, a container 100

includes one or more descriptive data structures 200 and associated control set(s) 316 relating to a sequence of “events” 700 that define a real estate transaction. The DDS 200 may, for example, include a number of different entries 200A-200N pertaining to each different  
5 “event” within the transaction (e.g., “offer”, “acceptance”, “purchase/sales”, “inspection”, “mortgage”, etc.). These entries 200A-N may, for example, define where in container 100 the event can be found. The entries 200A-200N may also include metadata that provides additional characteristics corresponding to the event (for  
10 example, how certain information related to the event should be displayed).

### **Example Descriptive Data Structure Formatting**

Figure 7 shows an example of how descriptive data structure 200 may be formatted. As mentioned above, descriptive data  
15 structure 200 may comprise a list such as a linked list. Each list entry 260(1), 260(2), ... may include a number of data fields including, for example:

- an object name field 262,
- one or more metadata fields 264 (which may be part of  
20 and/or referenced by the descriptive data structure); and
- location information 266 (which may be used to help identify the corresponding information within the container data structure 100).

The object name field 262 may include a constant that may corresponds to or describes a type of information. For example, object name field 262 may act as a “handle” to the content or data; it may be an indirect reference to the content or data; and/or it may be used to look up the content or data. The following are examples of object names:

General Purpose Object Names

	NUMBER
	STRING
10	DATE
	TITLE
	DESCRIPTION
	AUTHOR
	PROVIDER
15	MIME_TYPE
	VERSION
	URL
	EMAIL
	NEWGROUP
20	FILE_NAME
	KEYWORDS
	CREATION_DATE
	MODIFICATION_DATE
	LAST_ACCESS_DATE

	NATIVE_PLATFORM
	SIZE
	CONTENT
	PREVIEW
5	THUMBNAIL
	TEXT
	ARTWORK
	ILLUSTRATION
	UNKNOWN
10	TEMPLATE
	BILLING_NAME
	CONTAINER
	Book-style Object Names
	DEADLINE_DATE
15	TITLE_PAGE
	PROLOGUE
	INTRODUCTION
	ABSTRACT
	TABLE_OF_CONTENTS
20	CHAPTER
	CHAPTER_NUMBER
	INDEX
	Electronic Mail-style Object Names
	FROM

TO  
CC  
SUBJECT  
MESSAGE\_BODY  
5 ENCLOSURE  
Newspaper-style Object Names  
ISSUE\_DATE  
ARTICLE  
COLUMN  
10 COVER\_STORY  
LEAD\_STORY  
BREAKING\_NEWS  
ADVERTISEMENT  
SECTION  
15 EDITORIAL

The DDS 200 may include or reference any type of data or metadata. In one example, the DDS 200 uses the object name field 262 to point to or refer to metadata. This metadata can define certain characteristics associated with the object name. For example, such  
20 metadata may impose integrity or other constraints during the creation and/or usage process (e.g., “when you create an object, you must provide this information”, or “when you display the object, you must display this information”). The metadata 264 may also further describe or otherwise qualify the associated object name.

In one preferred example, the DDS 200 uses object name 262 to refer to metadata stored elsewhere – such as in a container 100. This referencing technique provides several advantages. For example, one situation where it may be useful to store the metadata in a secure container 100 separately from DDS 200 is in situations where it is desirable to make the DDS readily accessible to an outside application but to protect the associated metadata. For example, consider the case of handling web spider queries. A web spider may query the DDS 200 for a particular object name 262. If the object name is found, then the web spider may request the corresponding metadata. The web spider may have ready access to the metadata, but may only be able to access the associated metadata from the container 100 under appropriate conditions as controlled by a corresponding secure electronic appliance 500 based on associated rules 316. As another example, storing metadata separately from the DDS 200 may allow the same DDS to be used with different metadata in different contexts. Suppose for example that a DDS 200 contains an Object Name, for example KEYWORDS. When DDS 200 is associated with container 100A, then the DDS Object Name KEYWORDS refers to container 100A's KEYWORDS metadata. Conversely, if later this same DDS 200 is associated (e.g., packaged with) a different container 100C, then the DDS Object Name KEYWORDS refers to container 100B's KEYWORDS data.

Although it is preferred to use object name 262 to refer to metadata stored elsewhere, there may be other instances where there



is a need or desire to explicitly include metadata within the DDS 200.  
For purposes of illustration, Figure 7 shows an example DDS 200 that  
includes metadata field 264 and also refers to metadata within a  
container 100 using the object name 262. Either or both techniques  
5 may be used.

The DDS 200 thus allows value chain participants to protect  
the integrity of content, by enabling the specification of integrity  
constraints. DDS 200 integrity constraints provide a way to state rules  
about the content. For example, DDS 200 can specify that an article  
10 of a newspaper cannot be viewed without its headline being viewed.  
The corresponding integrity constraint can indicate the rule 'if there is  
an article, there must also be a headline'. Another example is a  
photograph that is part of a magazine and the credit that goes with it.  
The integrity constraint rule provided by DDS 200 might be 'do not  
15 present this photograph without its associated credit'.

DDS integrity constraints give value chain participants a tool  
for protecting the use of the DDS 200, ensuring that content  
represented by a particular DDS contains all the essential  
components--that it is representative of the DDS. This gives providers  
20 a way to set up conventions and enforce standards of use. There are  
many possible integrity constraints. The following are a few  
examples:

- Required: a is required as part of the content
- Optional : a is an optional component of the content

- Required relationship: if a is present, then b must be present, or if a is present b, c and d must be present. Conversely, if b is not present, then a is not allowed to be present. Relationships in this category are 1:m where  $m > 0$ .
- 5 • Optional relationship: If a is present b may or may not be present. If b is present, then a is guaranteed to be present. Relationships in this category are 1:n, where  $n \geq 0$ .
- Repetition: a must occur n times where  $n > 1$ . This could be specified with ranges of values, etc.
- 10 • Other rules and/or requirements.

Metadata 264

### **Example Graphical Interface For Creating Descriptive Data Structures**

Figure 8 shows an example descriptive data structure creation graphical user interface 312. In this example, the graphical user interface 312 may prompt the user for the object name. In addition, the graphical user interface 312 may provide options for specifying the associated metadata 264. The options shown in Figure 8 may, for example, include:)

- 20 • “construction type” metadata (upon object construction, the information is required; upon object construction, the object creation tool is to always or never prompt for the information);

- display metadata (e.g., always display the associated information (e.g., for copyright notices, author names and the like) or always or never make the information visible; and/or
- 5       • layout “hints” and field definitions (e.g., text, text block, integer, file, image or other data type).

The above metadata descriptions are non-limiting examples. Other metadata characteristics and attributes may be used.

#### **Example Process Using Descriptive Data Structures**

10       Figure 9 shows one example arrangement for using the infrastructure described in co-pending related U.S. patent application serial no. 08/699,712 (referenced above) for descriptive data structures 200. The arrangement shown in Figure 9 may be useful in a number of different contexts. For example, a provider 600 of  
15       descriptive data structures 200 may want to know which descriptive data structures 200 are the best liked by his customers so he or she can improve the quality of his products. Or, a provider 600 may charge customers for using descriptive data structures 200 on a per use or other basis. In still another example, some descriptive data  
20       structures 200 or classes of DDS 200 may be restricted to use only by authorized users or classes of authorized users.

Figure 9 shows a DDS provider 600 who delivers a DDS 200 and an associated control set 316 to a value chain participant 602.

Controls 316 may provide rules and associated consequences for controlling or otherwise affecting the use or other aspects of what value chain participant 602 can do with DDS 200. The controls 316 and DDS 200 may be packaged within a container 100. Value chain participant 602 may get the container 100 containing DDS 200 directly from DDS provider 600; alternatively, the provider can provide it a rights and permissions clearinghouse 604 and participant 602 and get it from the clearinghouse (or elsewhere) (see container 100B).

Value chain participant 602 can use DDS 200 to author content 102. Participant 602 can package content 102 with associated controls 316A in a container 100A. Participant 600 may, if he desires, include DDS 200 and associated controls 316a, 316b with content 102 in the same container – or depend on the provider 600 and/or rights and permissions clearinghouse 604 to independently deliver the DDS and its controls to end users 606 in another container 100c for example.

End users 606(1), ..., 606(n) use DDS 200 (in accordance with controls 316) in conjunction with content 102 (for example, to read, browse or otherwise access the container content). Controls 316, 316A may require user appliances to provide usage data 610 to a usage clearinghouse 612. The usage clearinghouse 612 can provide usage data 610A related to access and/or usage of DDS 200 to DDS provider 600, and may independently provide usage data 610B related to access and/or usage of content 102 to value chain participant 602.

**Descriptive Data Structures Can Be Used to Achieve  
A Degree of Interoperability Between Rights  
Management Environments**

Descriptive data structures 200 provided in accordance with the  
5 present invention can provide a degree of interoperability between  
source and target rights management environments, and/or to provide  
a bridge to achieve at least some degree of interoperability between  
a rights management environment and the outside world.

Different rights management environments may have  
10 substantially incompatible mechanisms for defining rights pertaining  
to an object. Descriptive data structures 200 can provide at least a  
partial bridge to achieve a degree of compatibility and  
interoperability. For example, a provider that defines an object within  
a source rights management environment may create a descriptive  
15 data structure for use by processes within one or more target rights  
management environments. For example, an object creator or other  
provider can specify, within a descriptive data structure 200, certain  
rules, integrity constraints and/or other characteristics that can or  
should be applied to the object after it has been imported into a target  
20 rights management environment. The target rights management  
environment can choose to selectively enforce such rules, constraints  
and/or other characteristics depending on the degree to which it can  
trust the source environment. For example, objects imported from an  
EDI system employing X.12 security may be more trustworthy than  
25 objects presented from environments with lesser (or no) security.

In another example, a provider that creates an object outside of any rights management environment can create a descriptive data structure 200 for use if and when the object is imported into one or more rights management environments. The target rights management environment(s) can use such descriptive data structure(s) to help efficiently understand and handle the object. Further, a descriptive data structure created within a rights management environment can be exported to one or more applications outside of the rights management environment and used to assist the application(s) in interpreting exported content or other information.

Figure 10A shows an example of how descriptive data structures 200 may be used to provide interoperability. In the Figure 10A example, a DDS creation tool 800 creates a DDS 200 that includes one or more target data blocks 801. In one example, the DDS creation tool 800 may be based on, and/or incorporate some or all of the capabilities of layout tool 300 and provide interoperability capabilities in addition to features associated with layout tool 300. In another example, DDS creation tool 800 may not incorporate any of the capabilities of layout tool 300, and may create DDS 200 solely for interoperability purposes. DDS creation tool 800 may, for example, be an application program with a graphical user interface, a background process that only displays a user interface when being configured by a user, a portion of an operating system, a portion of a computer's firmware, a server process that may act independently or as part or all of a "gateway" between one system and another (e.g., a

public network and a private network, two or more private networks, a local area network and a wide area network, etc.), or any other desirable implementation or integration.

5 Target data block 801 may provide information used to provide interoperability with a particular target environment 850. A single DDS 200 can, in one example, provide interoperability with N different target environments 850 by including N target data blocks 801(1), ...801(N) each corresponding to a different target environment 850(1), ... 850(N).

10 In this example, each target data block 801 includes rule (control) information. Different target data blocks 801 can provide different rule information for different target environments 850. The rule information may, for example, relate to operations (events) and/or consequences of application program functions 856 within the  
15 associated target environment 850 such as specifying:

- permitted and/or required operations;
- nature and/or extent of operations permitted and/or required operations; and/or
- consequences of performing permitted and/or required  
20 operations.

The target data block 801 may also include additional information if desired that gives directions to a DDS parser 852 and/or a translator 854 within a corresponding target environment 850.

Figure 10B shows one detailed example of how target information may be organized within DDS 200. In this example, DDS creation tool 800 creates a DDS header 805 that references one or more target record headers 807. DDS header 805 may, for example, include a “number of targets” field 809 indicating the number of target data blocks 801 within the DDS 200, a “offset to first target data portion” field 811 that provides the location of the first target data block 801(1) within the DDS 200, a source message field 812A that identifies the source environment, and an optional creator seal 812B that may be used to verify the integrity and authenticity of the DDS 200. Source message field 812A (which can be optional) may include a source ID that may be used to help verify the source environment of DDS 200, and an optional source seal (that may or may not be present in the source message). Each target data block 801 within DDS 200 may begin with a target record header 807 including a “target ID” field 813, a “length” field 815, a “offset to next target data portion” field 817, an optional creator seal 819, and an optional source message 821. The “target ID” field 813 may specify a unique identification number or value corresponding to the associated target data block 801 and/or identifying the intended target environment(s), the “length” field 815 may specify the length of the target data block 801, and the “offset” field 817 may specify the location (relative or absolute) of the next target data



block 801 within the DDS 200 (and may take on a null value for the last target data block).

5 The optional creator seals 812B, 819 (and source seals) may be cryptographic seals that help to ensure that the DDS 200 and target records 801, respectively, have not be altered since they were created, and also the identity of the DDS 200's creator and/or source. The optional source messages 812C and 821 may be information that helps to ensure that a target environment knows which source environment created DDS 10 200.

Referring again to Figure 10A, DDS creation tool 800 may, upon creating the DDS 200, cryptographically seal it and each target data block 801 for integrity using appropriate cryptographic processes, for example by first running a cryptographic hash function 15 (e.g., SHA, MD5, etc.) on the data and then encrypting the resulting hash value using a private key of the DDS creator associated with an asymmetric cryptosystem (e.g., RSA, El Gamal, etc.). If sealing is used, the DDS creator preferably should ensure that the public key associated with the encrypting private key is certified (e.g., encrypted 20 with a private key of a certifying authority) and available for use by target environments to validate the seal (e.g., by including a certificate in DDS 200, publishing the certificate on a public network, etc.)

If source messages 812C, 821 are used, they should preferably 25 represent information provided by the source environment that may

help a target environment identify the source environment, and further may also help to ensure that the DDS 200 was actually created by the source environment (and therefore may, for example, be trusted to the extent that the source environment is trusted). For example, a source environment may have a protected processing environment (PPE) of the form described in the above referenced Ginter, et al. patent application. Certain of such PPEs may have cryptographic keys (e.g., a private key of a public key/private key pair) available that may be used to encrypt a cryptographic hash taken of the DDS header 805 or target block header 807, as appropriate. In such an example, a target environment would need to acquire a corresponding cryptographic key (e.g., a public key of a public key/private key pair) using trusted techniques (e.g., delivery in a certificate signed by a trusted certifying authority) in order to evaluate such a source message. In another example, DDS creation tool 800 may have been equipped with cryptographic keys when it was manufactured, and may use these cryptographic keys instead of keys from a PPE, although generally this technique would be more susceptible to tampering by an experienced computer hacker and might therefore be somewhat less trusted by target environments.

In addition, or alternatively (for example, if cryptographic techniques are not appropriate or desired), the source message may contain a unique identifier that corresponds to the source environment.

The DDS creation tool 800 (see Figure 10A) may then package the resulting DDS 200 into a secure container 100 along with an associated object 830. In another example, DDS creation tool 800 may embed DDS 200 within, or otherwise associate the DDS with, an object 830' that provides a method for releasing the DDS to the target environment parser 852. The DDS 200 and its associated object 830 may then be delivered to one or more target environments 850 for processing.

Target environment parser 852 (and/or translator 854) may, for example, be part of an application program, part of an operating system, or part of a utility program used by, or in conjunction with, an application program and/or an operating system. The target environment parser 852 receives the DDS 200 and parses it to locate the target data block 801(k) corresponding to the target environment 850 (k). Parser 852 may then determine, from the corresponding target data block 801, the rules the target data block contains. Parser 852 preferably understands enough about the structure of DDS 200 to find (e.g., using the header information shown in Figure 10B) the appropriate target data block 801 corresponding to it, and also to understand the rules within the target data block. The target environment parser 852 doesn't need to understand any additional rules 316 that may be packaged within container 100 or otherwise delivered with object 830, but it may use any such additional rules if desired (e.g., when it finds no target data block 801 within DDS 200 for the particular target environment 850 (for example, if it is capable

of understanding some other target data block 801 whose rules are based on a published specification and/or standard)).

The target environment parser 852 may obtain applicable target rules from target data block 801 and provide these rules to application  
5 program functions 856. Application program functions 856 may define any operation pertaining to object 830 such as for example:

- cut
- copy
- print
- 10 • paste
- save
- change
- delete
- any other operation.

15 The target rules provided by parser 852 may be used, for example, to permit, require and/or prevent certain operations; to define the extent to which certain operations can be performed (e.g., limit number of copies, define extent of cut, the rules that should be applied to cut information in subsequent use, etc.); and/or to define  
20 the consequences of performing a particular operation (e.g., charge the user for printing or otherwise using and/or accessing all or part of object 830, maintain records of the time and/or number of such operations performed, etc.).

Parser 852 may also, or alternatively, provide some or all of the  
25 rules it obtains from target data block 801 to other arrangements for

applying the rules such as, for example, the “other rights management functions” block 858. Block 858 may provide any kind of rights management functions. Translator 854 may be used if needed to allow the application program functions 856 and/or the “other rights management” block 858 to understand the rules. As one example, translator 854 may be used to further elaborate, parameterize and/or secure the rule information obtained from target data block 801 so they are more or fully compatible with the “other rights management functions” block 858.

10           A useful data structure definitional method and arrangement has been described in connection with its most practical and presently preferred example embodiments. The present invention is not to be limited to those embodiments, but on the contrary, is intended to encompass variations and equivalents as defined within the spirit and  
15   scope of the claims.

**We Claim:**

1. A data processing method comprising:  
creating a machine readable, abstract descriptive data structure;  
and  
5 using the representation to interoperate with at least one rights  
management data structure.
2. A method as in claim 1 wherein the using step includes the  
step of formatting at least one part of at least one rights management  
data structure at least in part in accordance with the descriptive data  
10 structure.
3. A method as in claim 1 wherein the using step includes the  
step of formatting display of at least one part of at least one rights  
management data structure at least in part in accordance with the  
descriptive data structure.
- 15 4. A method as in claim 1 wherein the using step includes the  
step of formatting reading of at least one part of at least one rights  
management data structure at least in part in accordance with the  
descriptive data structure.
- 20 5. A method as in claim 1 wherein the using step includes the  
step of displaying at least a part of at least one rights management  
data structure based at least in part on the descriptive data structure.
6. A method as in claim 1 wherein the creating step includes  
the step of providing metadata within the descriptive data structure,

and the displaying step comprises displaying at least some information from the rights management data structure at least in part in accordance with the metadata.

7. A method as in claim 1 wherein the using step includes the  
5 step of dynamically generating a user interface based at least in part on the descriptive data structure.

8. A method as in claim 1 wherein the using step includes the step of automatically identifying and/or locating at least one data field at least in part based on the descriptive data structure.

10 9. A method as in claim 1 wherein the using step includes the step of automatically extracting data within the rights management data structure based at least in part on the descriptive data structure.

10. A method as in claim 1 wherein the creating step comprises creating a descriptive data structure that is independent of  
15 any particular rights management data structure but abstractly describes a class of rights management data structures.

11. A method as in claim 1 wherein the creating step includes the step of creating metadata for defining at least one characteristic of the using step.

20 12. A method as in claim 1 wherein the creating step includes the step of creating the abstract representation at least in part by using a wizard, the operation of the wizard being defined at least in part by a further descriptive data structure.

13. A method as in claim 1 wherein the using step includes the step of altering the behavior of a polymorphous process at least in part based on the descriptive data structure.

14. A method as in claim 1 wherein the using step includes the step of interpreting at least part of the descriptive data structure at run time.

15. A method as in claim 1 wherein the using step includes the step of dynamically adapting at least part of data processing of the rights management data structure at run time.

16. A method as in claim 1 wherein the using step includes using at least part of the descriptive data structure as instructions for driving and automated digital content handler.

17. A method as in claim 1 wherein the creating step includes the step of creating at least one integrity constraint, and the using step includes the step of enforcing the integrity constraint.

18. In a rights management data processing architecture of the type including a secure electronic appliance that interacts with an application through an interface, a method of interoperating with secure electronic containers comprising the following steps:

(a) delivering an abstract data structure representation to the application;

(b) generating container access requests with the application based at least in part on the abstract data structure representation; and



(c) accessing the container with the secure electronic appliance at least in part based on the container access requests the container generates.

19. A method as in claim 18 further including the steps of:

5 (d) providing, with the secure electronic appliance, information from the container to the application; and

(e) processing the provided information at least in part in accordance with the abstract data structure representation.

20. A method as in claim 19 wherein the processing step (e)  
10 includes the step of processing the provided information in accordance with metadata provided within the abstract data structure representation.

21. A method of creating and using a secure container comprising:

15 (a) defining a descriptive data structure that generically defines a class of interoperable, compatible container structures;

(b) using the descriptive data structure to create at least one secure container;

(c) distributing the descriptive data structure to plural  
20 electronic appliances; and

(d) interoperating with the secure container at said plural electronic appliances by at least in part using the descriptive data structure to locate and/or specify information within the secure container.

22. A method as in claim 21 wherein the descriptive data structure corresponds to an atomic transaction, and the method further includes the step of performing the atomic transaction at least one of said plural electronic appliances at least in part in accordance with the  
5 descriptive data structure.

23. A method as in claim 21 further including the step of independently using and/or providing controls relating to the descriptive data structure.

24. A method as in claim 21 further including the step of  
10 defining at least one class of descriptive data structure based on at least one parameter.

25. A descriptive data structure comprising:  
first data that at least in part establishes an association between the descriptive data structure with at least one rights management data  
15 structure;

second data that locates at least some information within the associated rights management data structure; and

metadata that at least in part describes at least one characteristic of use and/or access of the rights management data structure.

20 26. A descriptive data structure as in claim 25 wherein the metadata includes at least one integrity constraint.

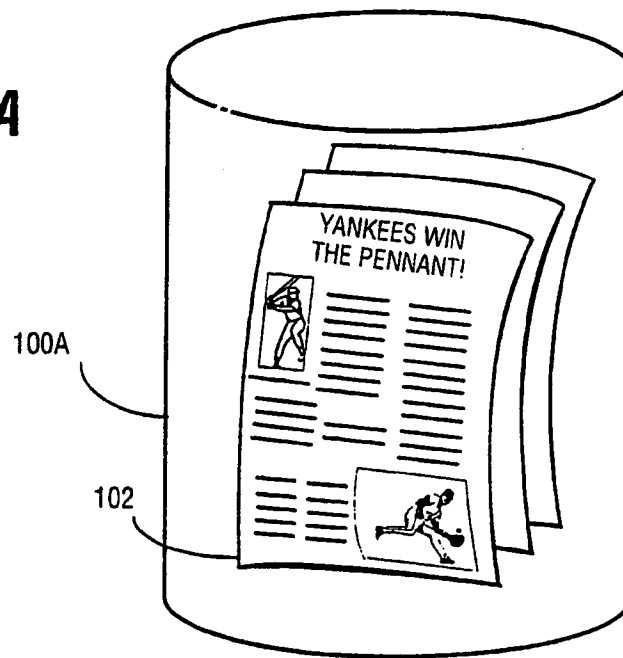
27. A method of achieving a degree of compatibility with at least one secure environment comprising:

- (a) creating a descriptive data structure;
- (b) associating the descriptive data structure with at least one object; and
- (c) presenting the object and associated descriptive data structure to the secure environment; and
- (d) interoperating with the presented object at least in part based on the descriptive data structure.

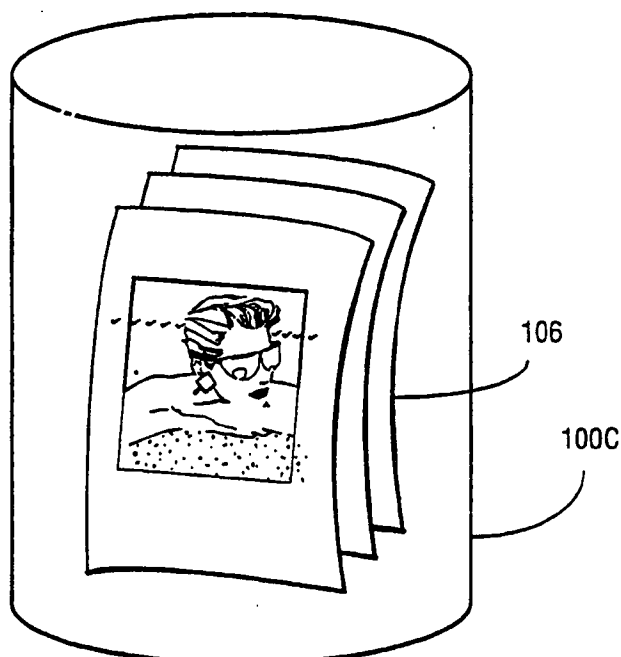
28. A method as in claim 27 wherein step (d) includes the step of selectively interoperating with the presented object based on the degree to which the secure environment can trust the source of the object and/or the descriptive data structure.

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**Fig. 1A**

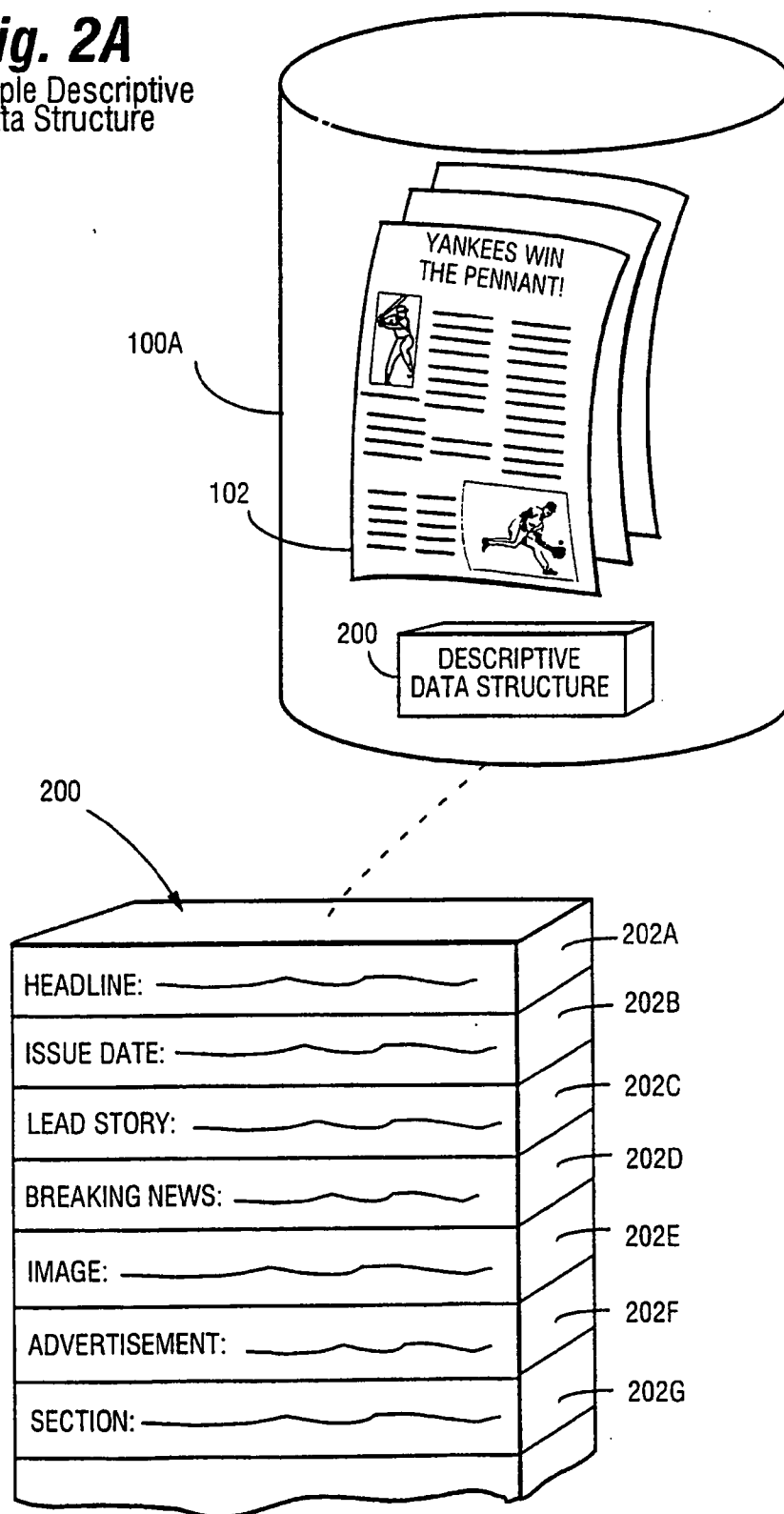


**Fig. 1B**

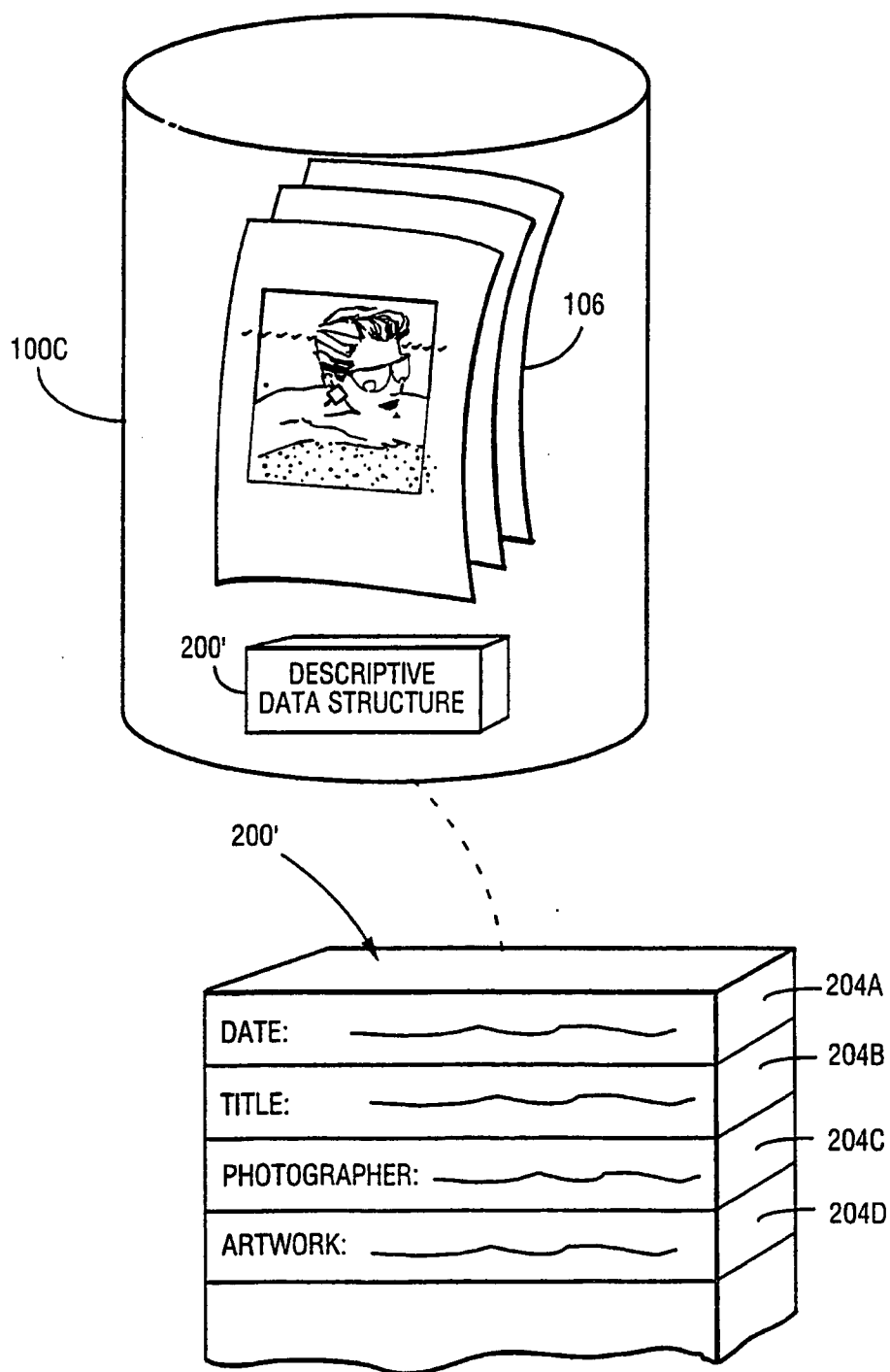


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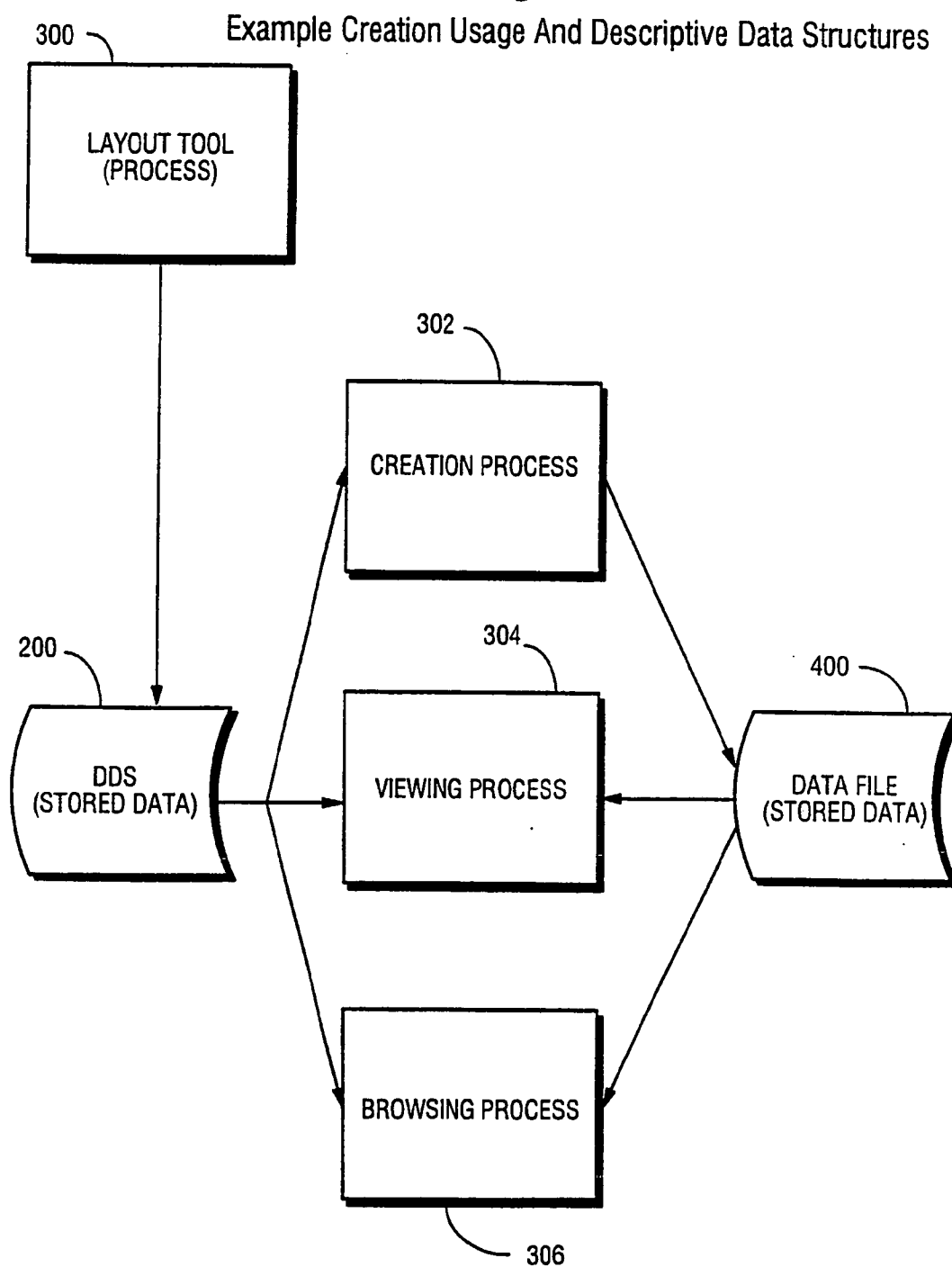
**Fig. 2A**  
Example Descriptive  
Data Structure

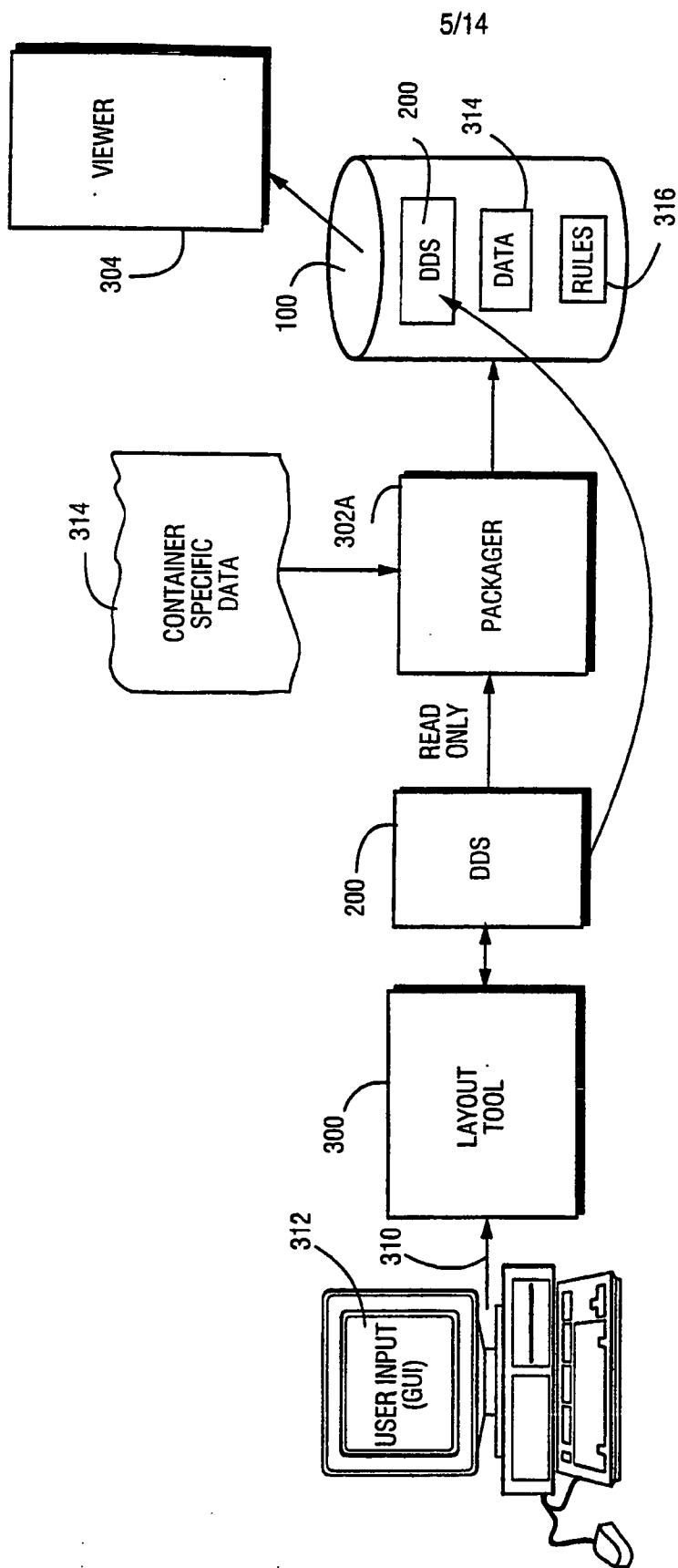


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**Fig. 2B** Example Descriptive Data Structure

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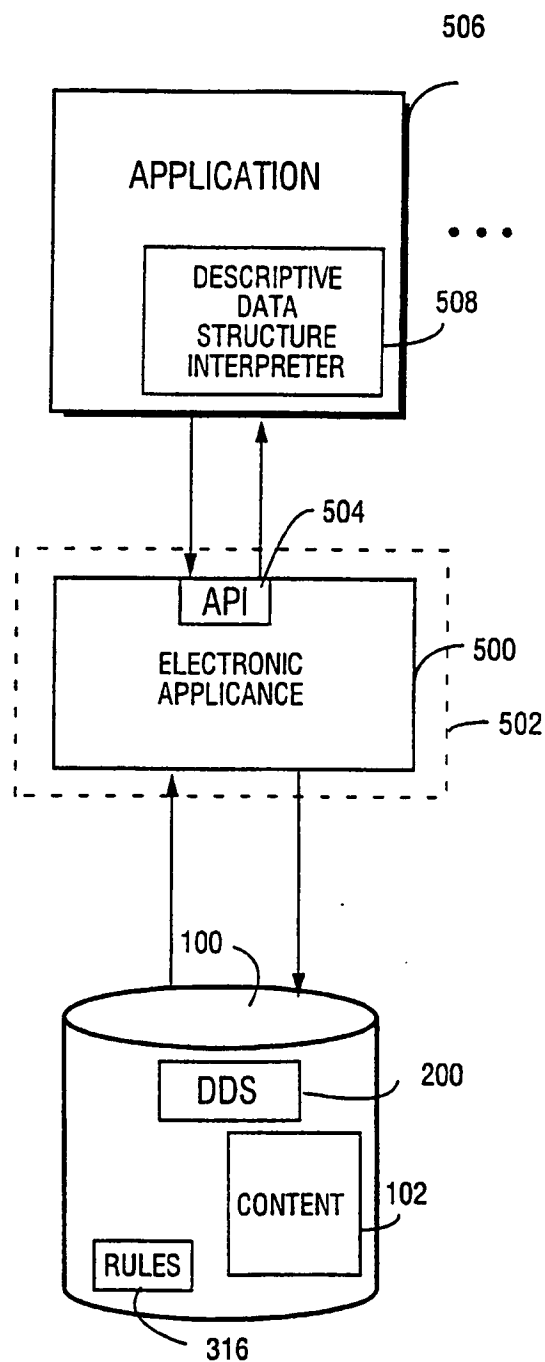
**Fig. 3**



**Fig. 4** Example Template Creation And Usage



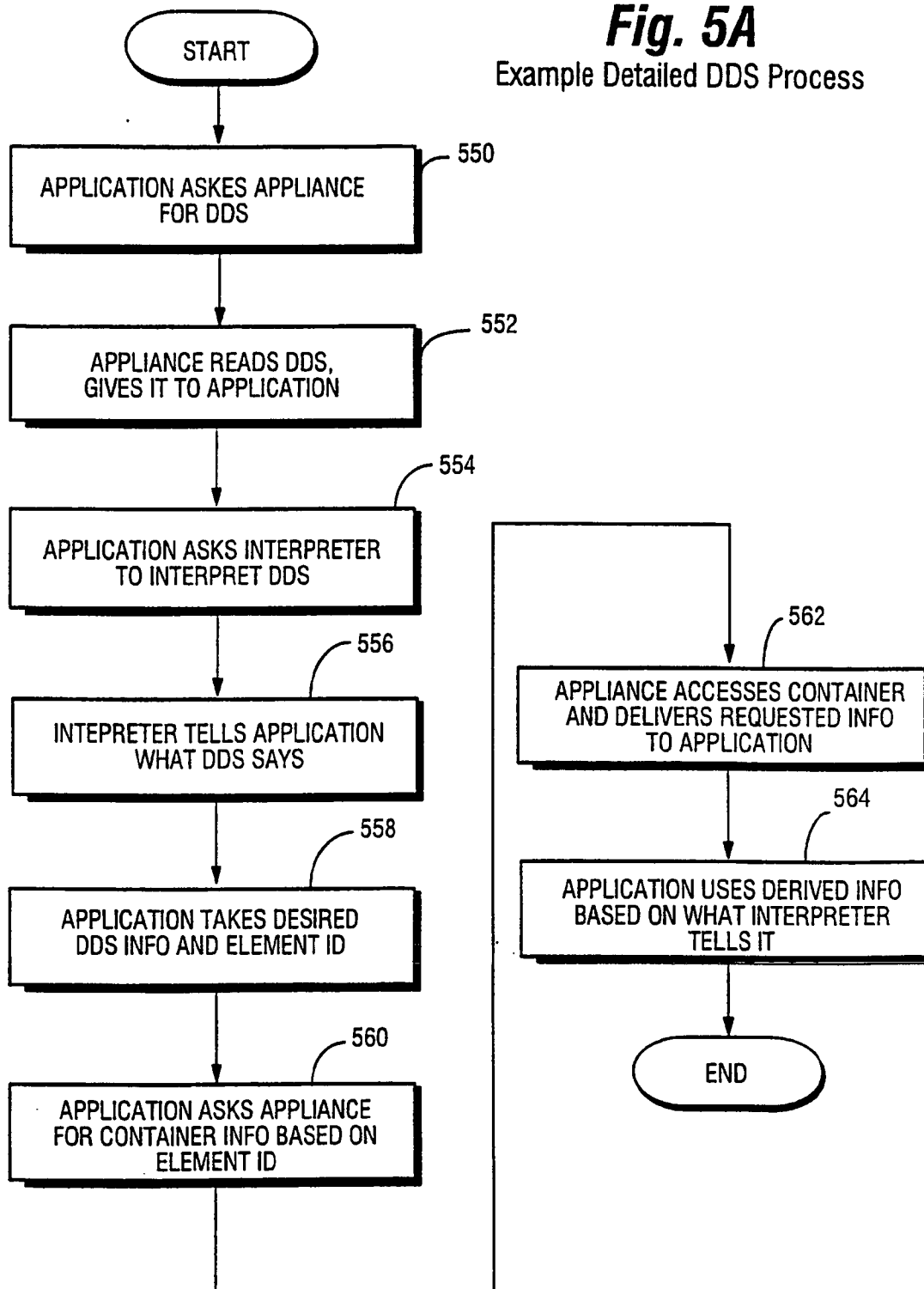
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**Fig. 5** Example Secure System Architecture

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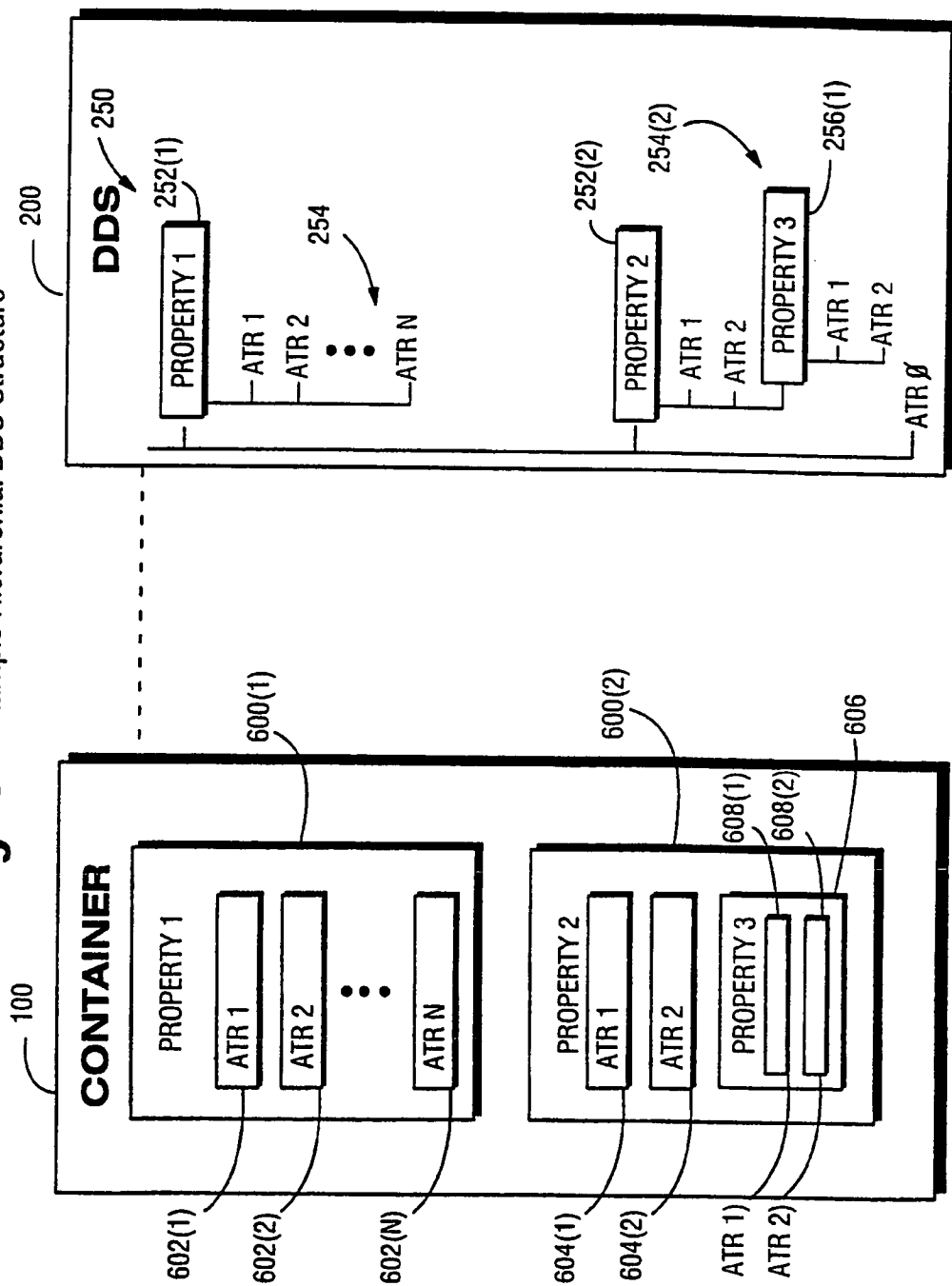
**Fig. 5A**

Example Detailed DDS Process



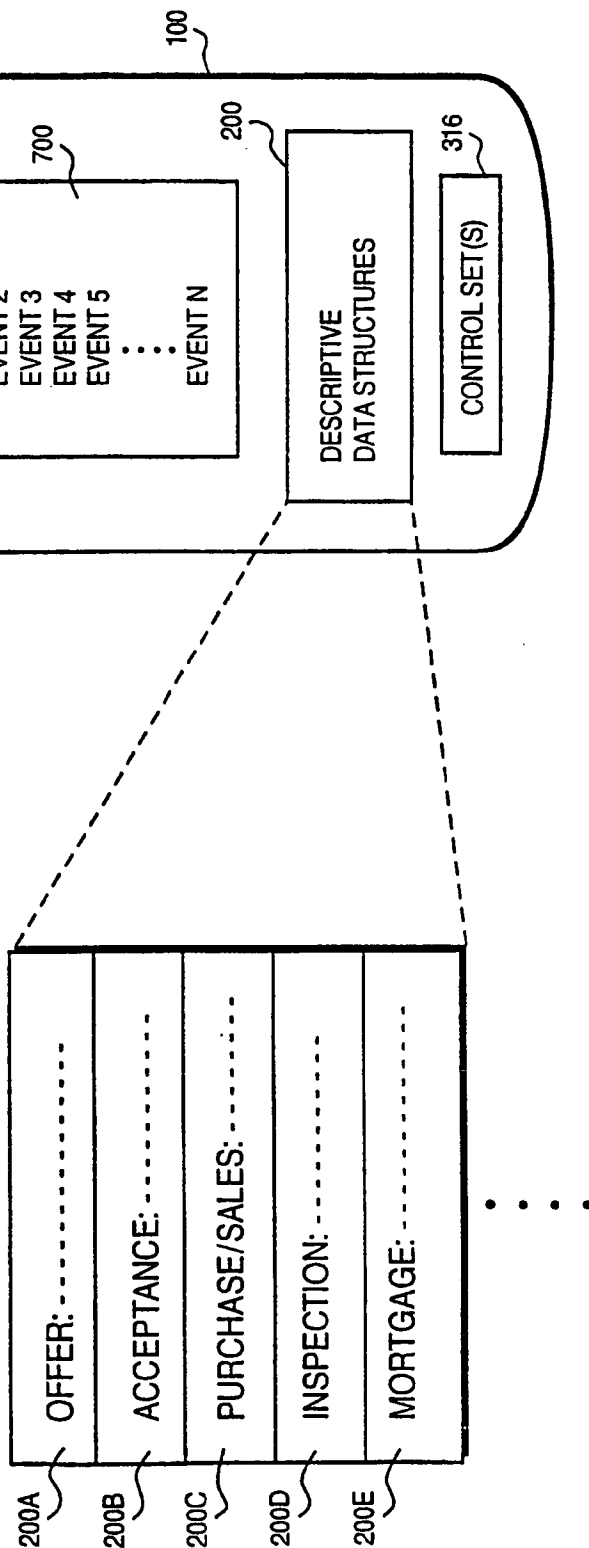
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**Fig. 6** Example Hierarchical DDS Structure

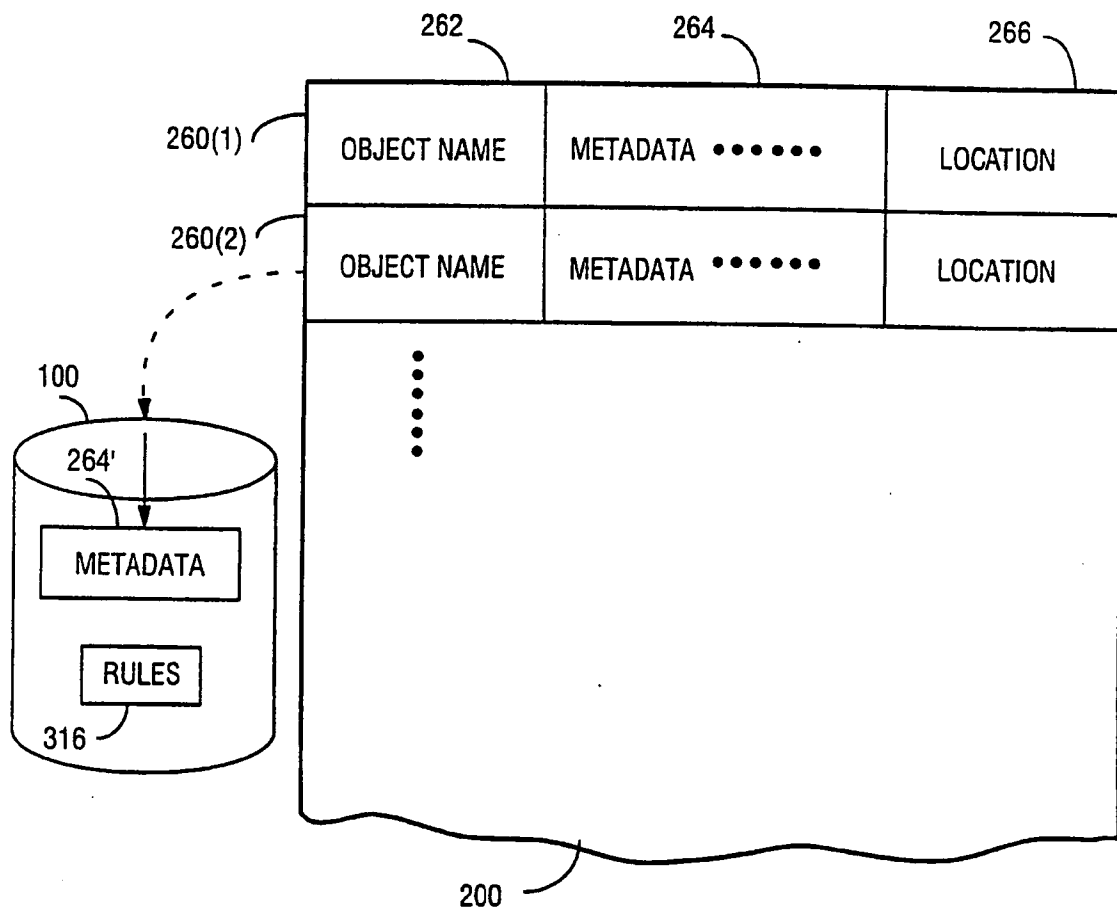


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**Fig. 6A** DDS Supports Atomic Events

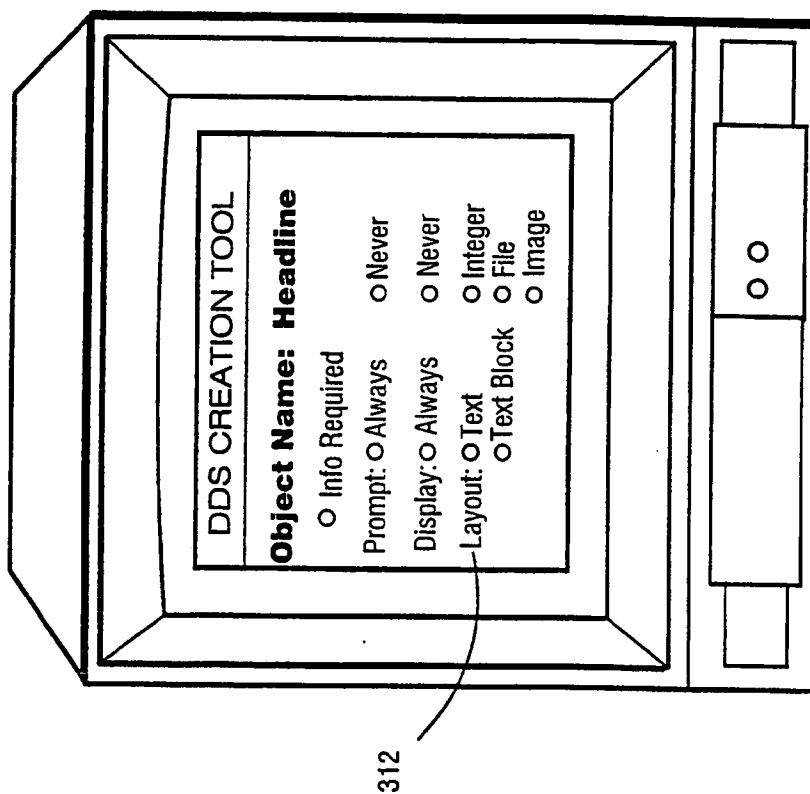


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**Fig. 7** Example Descriptive Data Structure Format

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**Fig. 8** Example DDS Creation Graphics Interface



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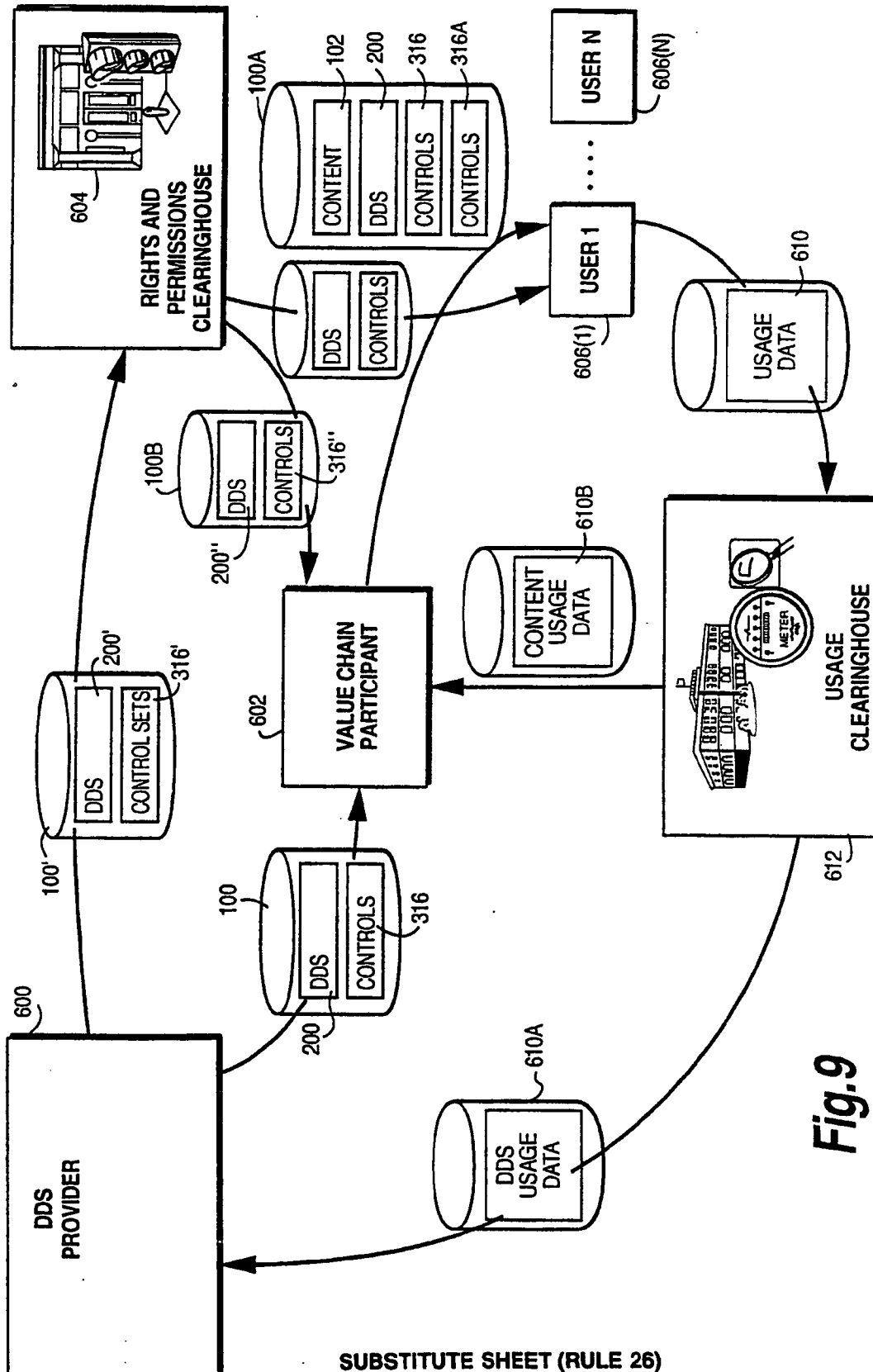
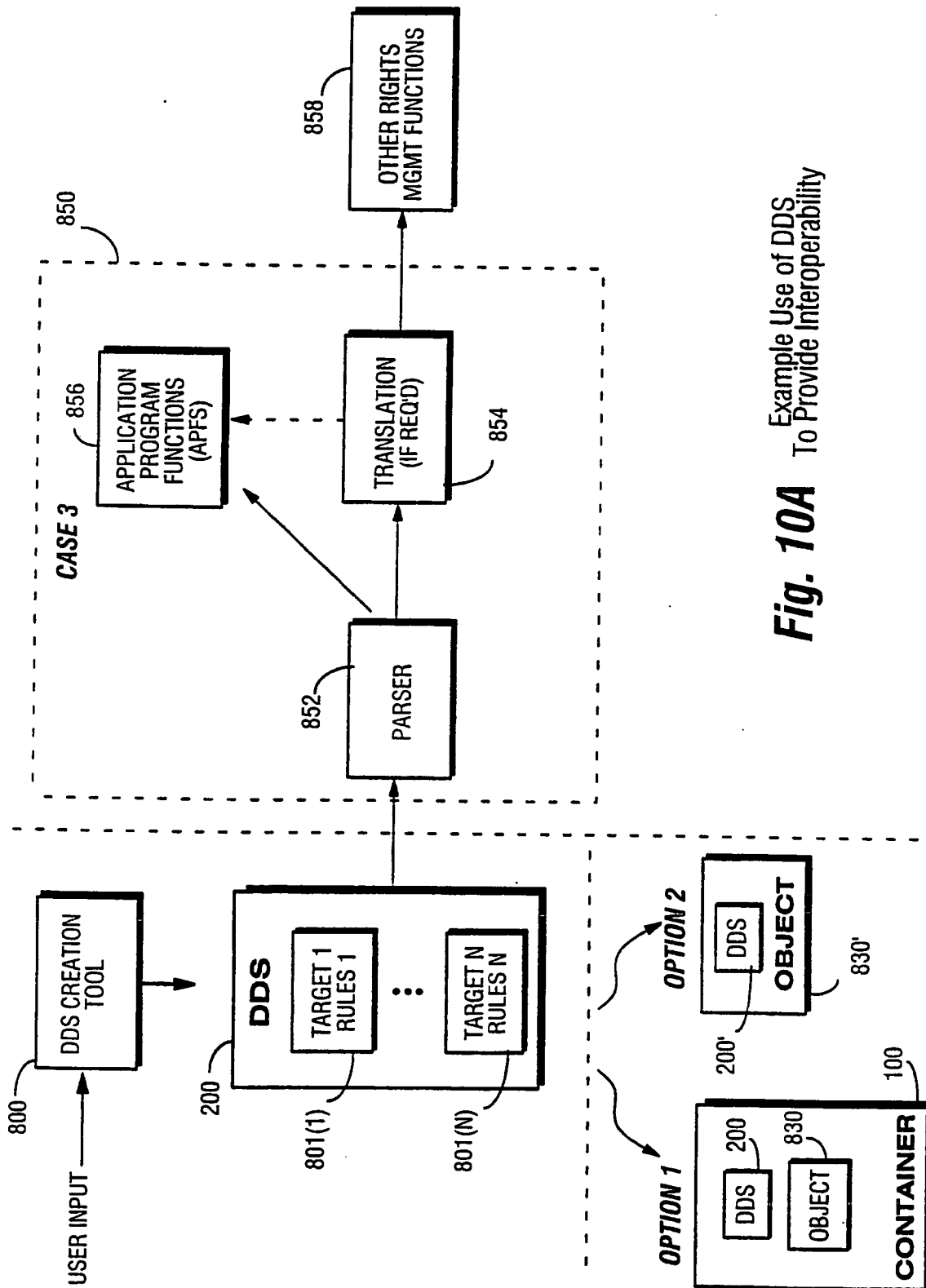


Fig.9

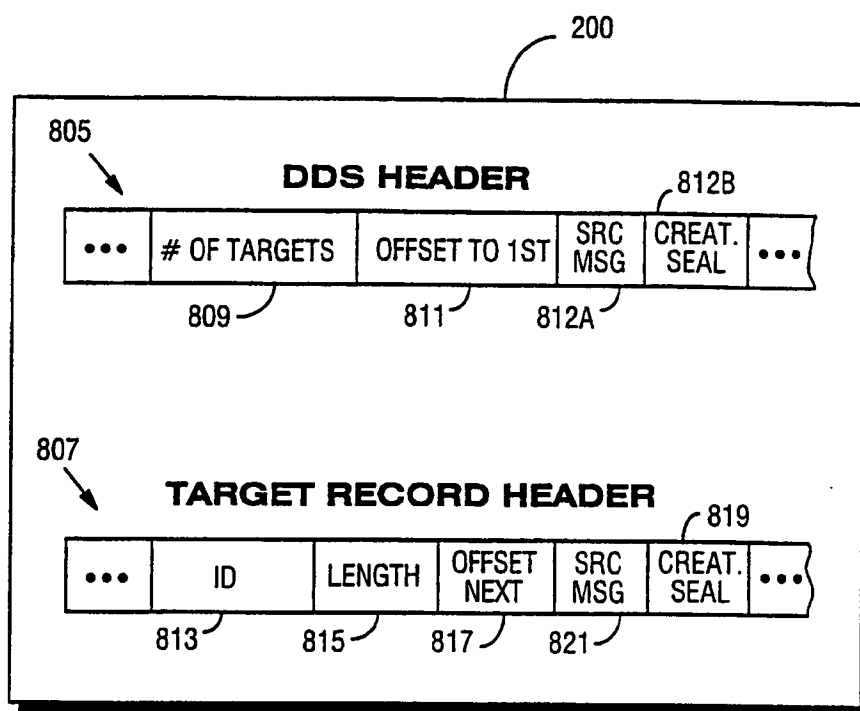
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**Fig. 10A** Example Use of DDS To Provide Interoperability



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**Fig. 10B** Example DDS Structure

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/03623

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G06F1/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 398 645 A (IBM) 22 November 1990	1-5, 25, 27
Y	see abstract; figures 1,2,4,5	18
A	see column 2, paragraph 4 - column 5, last paragraph	6,8,9
X	EP 0 565 314 A (FISCHER ADDISON M) 13 October 1993	21
Y	see the whole document	18
A	EP 0 456 386 A (INT COMPUTERS LTD) 13 November 1991	1-28
	see the whole document	
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search

26 June 1998

Date of mailing of the international search report

03/07/1998

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/03623

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>CHOU DHURY A K ET AL: "COPYRIGHT PROTECTION FOR ELECTRONIC PUBLISHING OVER COMPUTER NETWORKS"</p> <p>IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS,</p> <p>vol. 9, no. 3, May 1995,</p> <p>pages 12-20, XP000505280</p> <p>see the whole document</p> <p>---</p>	1-28
A	<p>EP 0 570 123 A (FISCHER ADDISON M) 18</p> <p>November 1993</p> <p>see the whole document</p> <p>-----</p>	1-28

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Information on patent family members

International Application No

PCT/US 98/03623

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